ELECTRONICS Australia

HiFi, Radio & Computers

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REVIEWED INSIDE: THE APPLE-II COMPUTER

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ELECTRONICS Australia

VOL. 40 No. 11 FEBRUARY, 1979

Australia's largest selling electronics & hi-fi magazine

STOP PRESS: Latest figures published by the Audit Bureau of Circulations (period April 1-September 30, 1978) show our circulation as in excess of 43,500 — documenting a lead of more than 15,000 over our nearest rival!

Built around a new Intersil evaluation kit, our new 3½-digit DVM features LCD readout, 10M input impedance, and four measuring ranges from 200mV to 200V. The details are on p54.

9kHz Whistle Filter . . .

Rid your AM/FM tuner of whistles with our new 9kHz whistle filter design. See page 58 for details.

On the cover

The colour graphics display of the Apple II microcomputer system featured this month is nicely complemented by pretty Sungravure staffer Sharyn Keeble. For a detailed review of the Apple II by an experienced user, turn to p93. (Apple II system pictured is by courtesy of Computerland Australia.)

FEATURES

HIFI TOPICS AND REVIEWS

PROJECTS AND CIRCUITS

AMATEUR RADIO, CB SCENE, DX

COLUMNS

DEPARTMENTS

IT'S NOT WHAT IT DOES, BUT WHAT IT UNDOES.

It's no wonder your records are flat. Before they're pressed, about half of the music's dynamic range has been squeezed out.

The vice is the recording process. Live music's dynamic range can be more than 100dB, but the studio recorders have only 58dB of useable dynamic range capacity. So the engineer has to compress the signal, making the loud sounds quieter and quiet ones louder. And that's where the live gets squeezed out of it. Your conventional discs offer less than 50dB of dynamic range.

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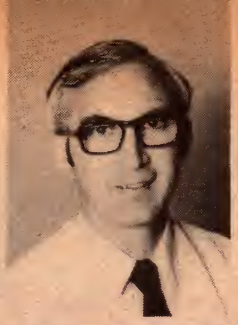

Editorial Viewpoint

The end of the cathode-ray tube?

One of the stories I think you'll find particularly interesting this month is the one starting on page 14, describing two new video displays which have been developed by Matsushita Electric in Japan. One of the displays is a new single-gun colour cathode-ray tube (CRT), while the other is a monochrome liquid-crystal display (LCD) panel which forms the heart of a tiny receiver.

The new colour tube is quite intriguing, as Matsushita has been able not only to produce a tube with only one electron beam and gun in contrast with the usual three, but also to do away with the conventional electron mask behind the phosphor screen. Until now, all colour tubes have had to have three electron beams and a mask of some sort to ensure that each beam only hit the dots or stripes of phosphor corresponding to the appropriate colour.

The new tube uses a multiplexing technique to fit all three resultant colour signals onto the single electron beam. Then it uses stripes of ultra-violet emitting phosphor so that the beam itself generates a feedback signal, which is used to ensure that the right colour signals are modulating the beam when it is over the various colour phosphor stripes.

This is certainly an ingenious approach, and one which seems to have many advantages: reduced power consumption, greater reliability and freedom from convergence problems to name only a few. But somehow I personally find the little LCD monochrome display even more impressive — not so much for what it is at the moment, but for what it is likely to portend in the future.

To be sure, there have been LCD panels and other types of flat-screen video display under development in laboratories for quite a while now, and each one was signalled as the "beginning of the end" for the conventional CRT. But now, it seems, Matsushita has come up with a fully practical LCD panel, and is about to put it into production sets. It looks as if the writing really is up on the wall (panel?), finally, as far as the CRT is concerned.

Perhaps in a way it will be sad to see the demise of the CRT, as it was after all the device which first made possible fully electronic television. Yet nowadays it is something of an embarrassment, its need for very high voltages making it scarcely compatible with modern solid state circuitry. Its departure, when it comes, will no doubt be a tremendous step forward in display technology.

— Jamieson Rowe

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News Highlights

The computer you can ring and talk to!

Researchers at Bell Telephone Laboratories have taken a major step in enabling people to speak directly with computers. They've devised an experimental system that can automatically provide directory assistance in response to a spoken request. The caller simply spells out the first five letters of the last name and then the initials.

The new system, which can comprehend most American dialects and some foreign accents, is able to understand a large number of people it has never heard before. This demonstrates one potentially simple and inexpensive way to make the value of computers more directly accessible to the public.

Though this experimental system is still in the research stage, it does bring closer the day when people can simply ask a computer for information or services, such as booking an airline flight or filing a memo.

The "ear" of the system is based on an automatic word recognizer devised a few years ago at Bell Labs. To recognize a spoken word, the computer quickly compares it with a file of stored reference patterns — representing the words in the computer's vocabulary — until it finds the closest match. The computer then produces a list of likely candidates in order of their similarity to the spoken word.

A self-correcting strategy is also built into the system. If the computer makes a mistake in recognizing a letter, it's likely to look for a name that isn't in the directory. So when it fails to find a name, it knows it's made an error.

The system builds up the name letter by letter, from left to right, checking the stored telephone directory after each addition to make sure the combination of letters exists. When it fails to find a match, the computer immediately substitutes the next letter in its list of likely candidates and checks the directory again. The system works backward and forward along the sequence of letters in the name, substituting one at a time until it finds a perfect match.

The combined efforts of the word recognizer and the self-correcting strategy make the system right about 97 times out of 100.

Writing aid/switch for the disabled

A typewriter that not only types, but can be used for switching electrical appliances on or off has been developed by a British company especially for the disabled.

Called "Popstar", it consists of a standard electric typewriter that fits into a special case. Using a hand or finger controlled joystick, a suck/blow unit or pressure pads for the hand, elbow or foot, a striker is moved up or down and from side to side along the keyboard to the appropriate key and then depressed. A variable speed adjustment enables the striker's movements over the keys to be increased or decreased to suit the skill and level of attainment of the user.

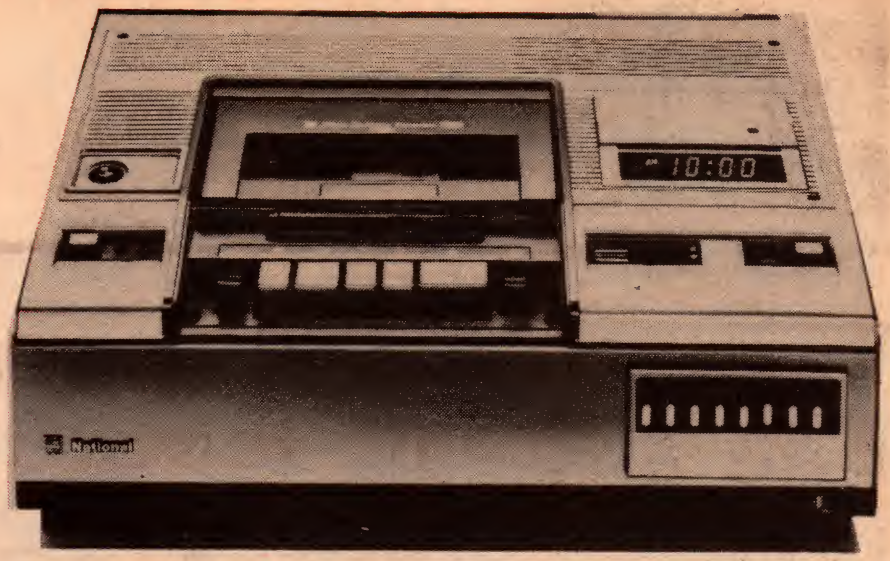
In addition to its use as a typewriter the equipment will also operate four pieces of electrical equipment simultaneously. The electrical appliances are simply plugged into the back of the equipment to a total loading of 13 amps. Because no special wiring is required, any appliance with a standard plug can be used. This could include an electric heater, a lamp, radio or television and an electrical door release.

Typewriting for the disabled — Popstar can be operated using pressure pads, a joystick, or a suck/blow unit, and can be used to turn mains equipment on and off.

The equipment is robust yet completely portable, needs no special installation and is expected to bring the benefit of communication and control to thousands of people to whom it has previously been denied. It is available in 220-240V and 110-120V versions.

Readers requiring further information should contact Rehabilitation Products Ltd, Pettaugh Lane, Gosbeck, Ipswich, Suffolk England.

New audio/video equipment from Japan



Recently released onto the Australian market, National's VHS VCR system is said to incorporate all the very latest features available in home video cassette recorders. These features include: a one-step 'M'-shaped tape loading system with a shorter tape path and quicker threading for faster response than conventional systems; a direct drive, quartz-locked head motor; and a one-piece, lightweight diecast chassis.

● **Sony Corp** has stretched the playing time of its pulse-code modulated (PCM) audio disc from 30 minutes to 2½ hours. The increased playing time was brought about in two ways: the disc rotates more slowly (450rpm vs 1800rpm), and has a higher recording density. Sony is currently investigating two more refinements. One would replace the player's helium-neon laser with a solid-state version; the other would slow the disc as the pickup moves towards the outer tracks, increasing playing time another 50 per cent.

● **JVC** has unveiled a new grooveless capacitive pickup "Video/Audio High Density Disc System". The player plays a 30cm plastic disc which contains up to two hours (both sides) of colour programs with sound. Alternatively, it can be used to play digitally recorded "super hifi" audio (PCM) discs, also developed by JVC. JVC says that no special components are required for player construction, and that both discs and players are economical to manufacture.

● **Universal Pioneer** recently put the finishing touches to its version of the MCA-Philips optical video disc system and shipped several samples to MCA. The company is a joint venture between Pioneer Electric and MCA, and aims to start full-fledged exports early in 1979. The discs are about the same size as ordinary audio discs, and give about 1 hour of colour programming. They can also be used for PCM recording and playback.

"Projects & Circuits" aids the blind

For most people, pouring tea or coffee into a cup is a fairly simple operation, performed without any conscious effort. But how does a blind person perform this otherwise simple task? In particular, how does he know when the cup is full?

Obviously, it is a serious problem for blind people and, until recently, the Royal Blind Society of NSW imported a simple electronic device, from England, which solved this problem very well.

Unfortunately, the supply of these devices dried up, and the Society put the problem to their voluntary technical adviser, Mr D. A. H. Champion; a retired electrical engineer.

Mr Champion found that it was not possible to duplicate the English model, due to the lack of some special components. Then he came across a simple water level alarm circuit in our "Projects and Circuits" handbook (p89), originally contributed by Mr A. Mann of Victoria.

Mr Champion obtained Mr Mann's permission to use the idea, and the result is the device in the picture. Most of the circuit is in the plastic box, including a small buzzer, with a sensor which hangs on the cup. The sensor consists of two wires, insulated except at the tip, which complete a circuit through the liquid.

Two sensors are provided, of different lengths, one for cups and one for jugs, saucepans, etc. Their operating level can be adjusted by bending. No switch is needed and the battery should have a very long life.

Mr Champion builds the units on a voluntary basis, for the cost of components, and the Royal Blind Society sells them at a nominal price.

$172M FOR UK MICROELECTRONICS

Britain's microelectronics industry is to recieve a £100 million ($172 million) boost over the next three years, according to an announcement by Prime Minister James Callaghan. This will bring the total sum committed to microelectronics by the government and private industry to more than £400 million ($688 million).

Mr Callaghan emphasised the crucial role which microelectronics would play in the industrial future of the nation and said Britain was now on the threshold of the most rapid industrial change in its history. He saw the development of an efficient microelectronics industry as a major element in future economic growth, and stressed the speed at which full adoption of the new technology must take place.

Government sources claim that Britain's investment stake in microelectronics is now bigger than that of either France or West Germany, and approaching the level of Japanese investment.

NEWS HIGHLIGHTS

New tuning system with non-volatile memory

EPM (Electronic Program Memory) is the name SGS-Ates has given to its new tuning system for radio and television receivers. The system features non-volatile semiconductor memory for digital storage of tuning voltage.

EPM is a modular system with many options and can be used with or without remote control. Station search can be either automatic, semi-automatic or manual.

The heart of the system is the M 193, an LSI N-channel MOS circuit which includes non-volatile memory for 16 channels (no battery back-up is required). A special structure developed by SGS-Ates for the memory cells (NV-RAM) is the key to the exceptional information retention capability of the memory which is said to outperform similar devices.

Ancillary circuits for the kit include the M 190 16-key encoder and latch (for use in TV sets where a remote control system is not included), the M 191 on-screen tuning bar generator and the M 192 channel number decoder and LED display driver.

Experimental telephone powered by light

Bell Laboratories researchers in the United States have devised a highly efficient light detector and transmitter to demonstrate the feasibility of operating telephones solely with the power of light transmitted over glass fibres.

They also devised a highly efficient means of converting electrical energy to sound energy for "ringing". Accomplishing this was very important since "ringing" takes much more power than any other function in a telephone.

The detector converts more than half of the light power to electrical energy — the highest photodetector efficiency yet reported. Moreover, the same detector doubles as a light source, greatly simplifying the problem of coupling separate detector and transmitter devices to the same end of a hair-thin fibre.

In a laboratory setup, a light-powered phone was connected to a simulated telephone company office over a one-kilometre length of glass fibre. The laboratory demonstration showed that light signals from a small semiconductor laser chip have enough energy to carry a range of telecommunications signals as well as power all the electronics in the telephone.

So, unlike various phones used today, a light-powered model would need no electricity (and no copper wire) from a telephone company office. Nor would it require any power from a wall outlet or self-contained battery.

News Briefs:

Australia buys Canadian satellite ground station

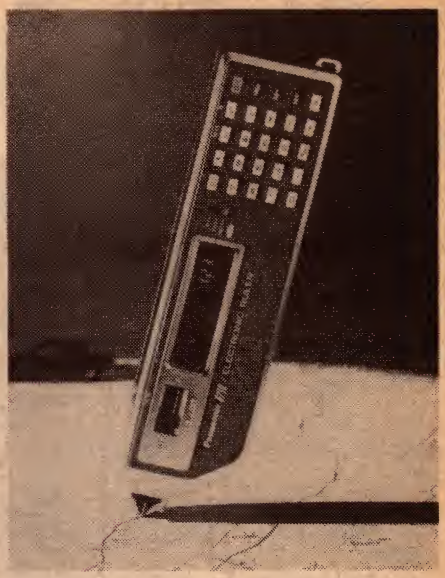
The Australian Department of Science is to spend $C4.5 million with a Canadian company — MacDonald, Dettwiler and Associates Ltd — for a satellite ground station to handle data from the current Landsat earth resources technology satellites. The ground station is currently being installed near Alice Springs, and is expected to be operational by the end of 1979.

Landsat data has a variety of practical applications in the fields of agriculture, forestry, land use, mapping, geology, water resources, oceanography, and the environment. There are currently three Landsat satellites in orbit, and additional satellites are in the planning stages.

NS to form joint company with Saint-Gobain

National Semiconductor Corporation has announced that it has reached a preliminary agreement with Saint-Gobain-Pont-A-Mousson to form a joint venture company in France to manufacture integrated circuits. Under the terms of the agreement, the new company will be 51 per cent owned by Saint-Gobain and 49 per cent by NS. Initial capitalisation will be 70 million French francs.

Electronic ruler with calculator



National Panasonic has developed a unique electronic ruler incorporating an 8-digit calculator with memory functions.

The ruler will measure straight or curved lines by means of a small wheel fitted to one end, and the resultant measurement can be fed directly into the calculator as a basis for computations. It is convenient for measuring distances on maps or charts, and in warehousing, textile, carpentry and engineering activities.

The electronic ruler, designated Model JE-8210 U, is available from electrical retailers, discount houses and department stores throughout South Australia for around $64.00. Distribution will probably be extended to other states at a later date.

Further information from National Panasonic (Australia) Pty Ltd, 57-69 Anzac Parade, Kensington 2033.

Vicom to distribute Jostykit

Vicom International Pty Ltd has been appointed Pacific area distributor for Jostykit of Denmark.

Jostykit is a leading manufacturer of high quality kits throughout Europe and is renowned for the attention given to aethestic design and presentation. The kits include comprehensive instruction booklets giving precise directions for assembly and testing together with circuit diagrams, drawings of components and soldering techniques.

Attractive Scandanavian-style extruded aluminium cases and knobs are available for most of the kits to give them a professional finish. About 40 different kits are now available and the range will later be extended to about 100 kits covering audio, laboratory, amateur radio and other interests.

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CEMA

NEWS HIGHLIGHTS

Statement by Minister for Mines and Energy

The NSW Minister for Mines and Energy, Mr P. D. Hills, MP, has released the following statement regarding electrical safety standards:

"Few people would question the right of the public to expect that all electrical goods offered for sale in the market place are electrically safe and will remain so through their normal working life.

"The New South Wales Government therefore looks to all sections of industry engaged directly and indirectly in the supply of electrical goods to the public to accept responsibility for ensuring that articles they handle comply with recognized electrical safety standards.

"Many appliances and some items of equipment have been specifically 'prescribed' under the Electricity Development Act in New South Wales and are required to be examined and approved by the Electricity Authority of New South Wales or an approvals body in another State, and to carry an approval marking, prior to sale.

"As the responsible Minister I also look to the Electricity Authority to monitor the general safety standard of electrical goods of different types offered to the public and to recommend application of legislative control where necessary.

"I have been concerned to learn through reports of recent Electricity Authority inspections of electrical and electronic equipment of the type featured in the columns of some publications that many of the items examined do not comply with safety standards published by the Standards Association of Australia. Several cases have also been reported by the Authority of products which come within the scope of prescribing definitions being offered for sale without approval.

"In particular it appears not to be realised that the prescribing definition for 'Extra Low Voltage Transformer' includes a number of regularly advertised items such as power supplies of different types, antenna boosters and antenna rotators.

"Most sections of the electrical industry supplying consumer goods have developed a safety awareness through knowledge of S.A.A. safety standards and regular contact with regulatory authorities on approvals matters.

"However it is clear that the popular electronics (hobby/enthusiast) section of the industry is giving insufficient attention to safety requirements.

"It seems clear to me that the first need is for people operating in this section of the industry to be better informed of their responsibilities and obligations in the electrical safety area. In New South Wales closer contact with the Electricity Authority would certainly assist in this regard and I have asked the Authority to give priority to fostering that contact in its safety enforcement work.

"Through these columns I also make a general appeal to manufacturers, importers and retailers in New South Wales to co-operate with the Authority and assist in ensuring that all popular electronics goods offered to the public fully comply with Australian safety standards."

Editorial Note: Guidance and technical advice may be obtained by contacting your state regulatory authority. These are:

The Electricity Authority of New South Wales, 50 Miller St (PO Box 456), North Sydney 2060. Telephone 92 4171.

The State Electricity Commission of Victoria, Monash House, 15 William St (GPO Box 2765Y), Melbourne 3001. Telephone 615 0433.

The State Electricity Commission of Queensland, Cnr Gregory Terrace and Warry Sts (GPO Box 10), Brisbane 4001. Telephone 52 2701.

The Electricity Trust of South Australia, 220 Greenhill Rd (PO Box 6), Eastwood 5063. Telephone 223 0383.

The State Energy Commission of Western Australia, 365 Wellington St (GPO Box L921), Perth 6001. Telephone 25 0561.

The Hydro-Electric Commission, Tasmania, 4-16 Elizabeth St (GPO Box 355D), Hobart 7001. Telephone 30 1101.

Laser pin-points wafer defects

An experimental laser-scanning method that can detect microscopic defects in silicon wafers has been developed by IBM scientists. The method has potential importance, because even one such defect can cause the failure of a complete circuit containing thousands of transistors.

The surface of the silicon wafer is scanned with a laser beam. As it scans, the beam excites and frees electrons, some of which travel to the surface of the wafer and are detectable as a voltage. This voltage remains steady as long as the surface being scanned is perfect.

When the beam passes over a defect, however, some of the excited electrons recombine in it, and the surface voltage drops. After the beam passes the defect, the surface voltage returns to normal. These voltage changes are registered on the screen of a cathode ray tube, forming pictures that can be interpreted as representing various defects such as scratches, cracks, dislocations, precipitates, and other imperfections.

The method takes a minute or less per wafer and can spot imperfections as small as 1 micrometre. Because the method is non-destructive, it can be used to examine silicon wafers for defects before devices are fabricated on them. It also offers the possibility of examining wafers at several stages in the circuit-manufacturing process in order to determine which steps need adjusting to improve the process yield.

Sodium/sulphur battery for rail cars

A significant step forward has been made in the development of sodium-sulphur (Na/S) batteries for transport applications with the recent press announcement by British Rail that a 10kWh battery has been successfully activated. Initial tests have shown that the battery is safe, reliable and can be easily and quickly assembled. It is built from 176 cells and has a capacity of 288 ampere-hours at 45 volts.

The Na/S battery, which operates at 350°C, has a practical energy density of five times that of conventional lead-acid batteries. The UK Atomic Energy Authority's Harwell Research Establishment has been engaged on work involving the Na/S battery since 1972. During the last three or four years the battery has been developed jointly by British Rail, Chloride Silent Power Ltd (Runcorn), and Harwell in a collaborative national program.

British Rail's long-term intentions are to use Na/S batteries for light-weight rail cars on branch lines.

The TV set of the future could guard your home, summon emergency services, and do your shopping. You could tell it when you're bored, and one day you may even vote with it from the comfort of your armchair.

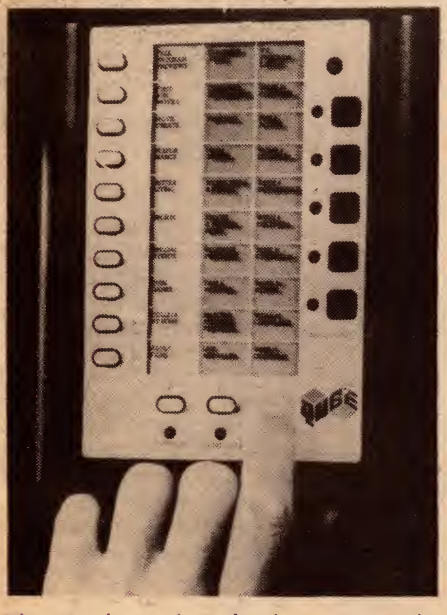
The television you can talk to!

by SUE THOMAS

The television of the future will guard your home, do your shopping and entertain you. What's more, you will be able to talk to it!

Just press one of the buttons on the console, and you can vote on a local talent show, or book a restaurant. In time, you may even be able to elect the next prime minister, all from the comfort of home.

How will this be done? Well, the system is called "Qube" and Ronald Castell, Vice President of Marketing at Warner Cable Corporation, the people behind the project, says: "For the first time, viewers will be able to actively participate in the program they are watching."



The 30-channel Qube home console. By pushing the appropriate buttons, viewers can choose programs and tell the television company what they think.

So far, Qube has only been tested in one American town, Columbus, Ohio, but it's getting good reactions. One satisfied customer said: "You're just more part of it. It's a lot more fun knowing you're the one doing the judging.".

And judge they do. Every day on the community channel there is an amateur talent contest. Viewers can vote from their armchairs, and it's their vote that counts.

Each performer has 40 seconds to do their thing before the audience is commanded: "Touch Now". The verdict is flashed on the screen. The people have spoken. The majority rules, and if more than half the viewers don't like the act it's goodbye to the contestant.

Gustave Hauser, Chairman of Warner Cable, believes that "people like to be involved with television beyond watching it".

"Maybe it's a response to loneliness but they seem to welcome being asked questions that they can answer by pushing buttons," he added.

One viewer has a more basic theory with regard to the talent show. "The kids love to watch it," he said. "They like to hit number four button — that's the hook that gets the guy off the stage."

And it doesn't stop there. A live show could be stopped before its time if more than half the viewers don't approve. That would be fine if you're one of them, but not so funny if you're one of 49% who was loving every minute.

Qube families pay a small monthly subscription for the talk-back system. Each family is supplied with a small computer terminal, about the size of a shoebox, which sits under the television set, and a pushbutton console for the viewer to hold.

This has three columns with ten buttons in each. The "T" column is the one to press for regular channels, "P" indicates that programs from this column cost extra, and "C" indicates a community channel. It's the "C" channel that Qube viewers find the most exciting because this is the one which invites response via the pushbutton console. This is the one you can talk to!

How does the system work?

A dual cable feeds TV signals via the receiver to the computer terminal. Four central computers sweep the terminal every six seconds and record such detailed information as which sets are on, and which channels are being watched. They tabulate viewers' responses to spoken or written questions and can even record the reactions of individual homes.

But it's this ability of Qube to record individual viewing patterns that has made a few wary people wonder if the era of "Big Brother" is close at hand. The implications of Qube are obviously more far-reaching than simply voting on a local talent show. For instance, it could revolutionize the world of politics.

And while the prospect of an instant election by television terrifies many politicians, Qube officials are eagerly awaiting the one who makes a statement, and then dares to ask: "How many of you believed what I just said?"

But it is just these political implications that are worrying some people. They fear that politicians could phrase certain questions to ensure getting the answer they want. And the politicians worry that the box in the

corner will reveal things about them they might not wish to be known.

For instance, the extensive choice in column P allows the viewer to be his own TV programmer. On button 10, the P is for porn and viewers can ogle at the Khama Sutra riding again and again should they wish — for a modest fee, of course. The computer will bill them at the end of the month.

Another popular channel is called "drive-in" where blood and guts abound in quantities that would turn weaker stomachs.

And for those parents who might lose sleep worrying that their ten-year-old could be turning on to more fleshy temptations when left alone, there is the security of the Qube key which disconnects all pay programming.

But some people are worried as to whether they will be able to watch a few suspect films unnoticed.

"Would it not be possible," they ask, "for Qube to tabulate every pervert in the proximity who is tuned to channel P10?" Qube executives say no, the computer never records individual names and addresses unless the viewer wishes.

But Gustave Hauser has a suggestion which would make the feeding of a political candidates' lust to a hungry public impossible. "If you're in a position where you could be blackmailed, don't watch blue movies," he said wryly.

Harlan Kleiman, Vice President for Qube programming, is less flippant: "We have a time bomb here. We have to be extremely careful and set up very strict rules. If we abuse them, we're fools."

Qube isn't completely ready for large scale application yet, but in the meantime it is being kept busy. The constant monitoring makes alternative rating systems a thing of the past.

The central computer which sweeps the cables every six seconds reports back instantly to programmers exactly which programs are being watched. It can track down information that advertisers would kill for.

Gustave Hauser is confident that the commercial aspect of Qube will be a success. "Advertisers who are getting involved with Qube see it as a whole new way of relating to viewers," he said. "What's different about their adverts is that they are more information and research orientated. For the first time the advertiser can use television to have a direct dialog with the consumer."

Market research would be made simple. Advertisers could flash questions on the screen — "Which of these products would you buy? Which slogan do you prefer?" Predetermined viewers could receive product samples and then be quizzed on response. Advertisers could conduct magazine readership surveys. Viewers could be paid to participate.

"We can do research 88 ways," boasts Hauser.

But there is a risk, Kleiman warns. "We have to be careful not to exploit it. There's a bell curve of interest. We have to be careful of reaching the point where the viewer says 'We'll pay you anything but *please, please* don't ask our opinion any more!' "

Qube is there to help as well as to gain. It even has its own friendly fraud catcher in the form of Jon Steinberg, nicknamed Mr Qubesumer. He reigns supreme on Qube C6, where his acts on behalf of the helpless shopper are the stuff heroes are made of.

Every week he compares the prices in all the major regional shopping centres, to save thrifty housewives the trouble. Regular as clockwork, he transmits the relative prices of goods ranging from baby food to bourbon. Other days in the life of Mr Qubesumer include exposing frauds, like the time he demonstrated that a bowl of soup at a local restaurant cost twice as much as a cup, when both held the same volume, and warning unsuspecting citizens that their "vine-ripened" tomatoes were really "gassed pink" in a nearby warehouse.

Adding to its talents, Qube will shortly offer fire and burglar protection, made possible by the computer's six second sweep of all households. These systems are armed with ingenious trick-proof codes. For instance, if a burglar forces the house-owner to disconnect the alarm, the warning sirens stop, but the computer passes on a "better hurry" message to the local police station.

Also coming soon is an emergency medical service.

An elderly or housebound person within 150 feet of home can press a "panic button" necklace, and within seconds an ambulance will be rushing to the scene, equipped with the victim's medical history and "even the phone number of the mother-in-law in California," says Mike Korodi, Qube's general manager in Columbus.

Other benefits that Qube offers would be invaluable to the aged and handicapped. For one thing, shopping could be done without leaving the home. The TV displays goods. A touch of the button brings the goods of your choice — and the bill — to your home. Restaurant bookings could also be made, and bank statements could be called to the screen at the push of a button.

Qube can be educational too. Viewers can have various courses channelled into the living room at their request, whether it be to study anthropology or correct a golf swing. The obvious advantage of Qube TV courses is 2-way communication.

The professor might ask, "Am I going too fast?" or even "Am I boring you stiff?" Personal contact is important, and Professor Qube begins by checking the register — "Nice to see you back Johnny."

No doubts that Qube is versatile. It allows viewers to learn, buy, boo and vote from the comfort of home.

You may be able to talk to your TV sooner than you think!

A family in Columbus, Ohio, watch television using the Qube two-way system. The home terminal unit can be seen on the table top, in front of the TV set.

RCA 'Gold Chip' devices: improving IC reliability

One problem with conventional integrated circuits is that they are prone to sudden failure in very humid environments due to moisture penetration. This can be solved by using hermetically sealed devices but, up until now, such devices have been expensive to produce. Now RCA has come up with a low-cost solution to the problem.

by BRIAN DANCE

One of the major causes of equipment failure in extremely humid or wet areas is due to the penetration of moisture into conventional plastic encapsulated integrated circuits. In the past, aluminium has been universally used for the interconnections on all chips, but is easily attacked by moisture. The latter may penetrate through the plastic material (especially if the environment is either acidic or alkaline), or may enter at the interface between the package and the leads. This penetration is greatly accelerated by rapid temperature changes or by severe mechanical shock.

The water converts the very thin layers of aluminium on the chip into aluminium oxides and hydroxides, which have very low conductivity. Thus an open circuit can develop between elements on the chip of between one of the connecting leads and the chip, rendering the device useless.

It is, of course, possible to prevent this type of failure by using hermetically sealed packages which water cannot enter. For example, chips can be sealed into a cavity formed in a ceramic dual-in-line case, the cavity being filled with an inert gas and the pin connections "frit-sealed" with glass. Unfortunately such hermetically sealed packages are expensive to produce and devices using them cost several times more than a similar device in a conventional plastic dual-in-line package.

Hermetically sealed devices are therefore used mainly in military equipment and in equipment used in difficult environments where reliability is more important than cost. The home constructor seldom meets integrated circuits of this type.

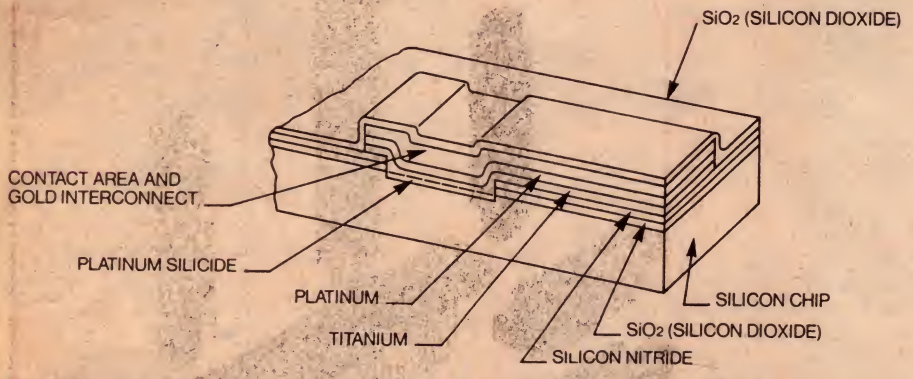


Fig. 1: Structure of a tri-metal device, showing different metal and passivation layers. Gold, platinum and titanium are the three metals used.

Reducing the Cost

In an effort to achieve high reliability and yet keep costs low, RCA has developed a process in which the hermetic sealing is accomplished not by sealing the device into a special package, but by sealing the chip of the microcircuit itself. This is done by depositing suitable metallic layers on the silicon chip.

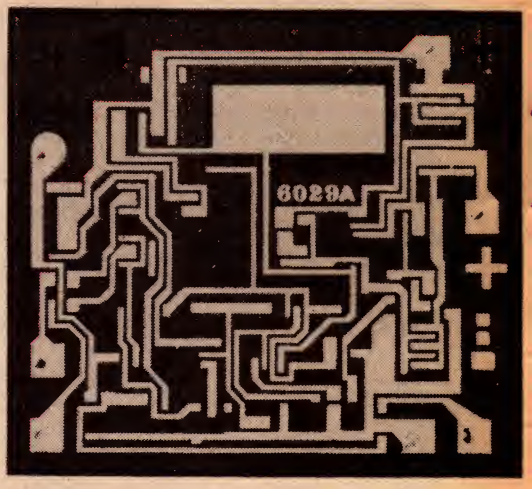


Fig. 2: Photomicrograph of CA741G chip shows gold metallization in areas where aluminium metallization normally exists (light areas in photo).

One of the main advantages of this new "hermeticity on a chip" process is that it can be carried out much more economically than hermetically sealing the microcircuit into a relatively expensive package. Indeed, the cost differential between the new process and that of conventional integrated circuit production is so small that RCA has been able to offer its new hermetically sealed devices for the same prices as devices manufactured by conventional techniques.

The Tri-metal Process

Basically RCA's new "Tri-metal" process involves the application of three precious metals (titanium, platinum and gold) over the places where the individual transistors on the chip are interconnected. Thus corrosion failures are eliminated. Silicon nitride is used for passivation.

The device production follows the conventional procedure until the final oxide step. A layer of silicon nitride is applied at this point to hermetically seal the junctions. A standard masking operation is then used to open the contact windows. Platinum is sputtered over the wafer and is sintered into the areas where the contacts will be formed

so that it is converted into platinum silicide. Titanium and platinum layers are sequentially sputtered on the surface of the wafer (Fig. 1).

The pattern of interconnections is defined in the platinum layer by the use of standard photoresist techniques. With photoresist masking, a gold layer is electrolytically plated on the platinum interconnecting runs to provide good conductivity. Finally a protective layer of silicon dioxide is deposited on the chip, as in conventional integrated circuit production.

The Three Metals

The titanium is used to improve the adherence of the metals to the silicon nitride. The platinum acts as a barrier layer between the titanium and the gold layers, whilst the gold provides the high conductivity and a reliable metallization pattern.

Types Available

RCA has made six device types available with hermetically sealed chip surfaces. These have the same characteristics as other standard devices, but a letter "G" is added to the device coding to identify the "hermetic-in-plastic devices".

One of the new devices is the CA741CG, this being equivalent to the standard 741C operational amplifier in an 8-pin dual-in-line case. The CA747CG contains two 741C type operational amplifiers in a single 14-pin dual-in-line case. CA741G and CA747G types are also available, these being equivalent to the 741 and 747 devices.

Another hermetically sealed chip is the CA324G, this being a quad operational amplifier. The four amplifiers in this device are especially convenient to use, since they have been designed to operate from a single supply voltage of any value between 3V and 30V, whereas most operational amplifiers require balanced positive and negative supplies. Electrically, the CA324G is equivalent to the 324 device and will operate linearly even if the input voltage falls to the negative supply line potential.

Another device is the CA339G, a quad voltage comparator which is electrically equivalent to the 339 device. Other Gold Chip devices include the CA3724G and the CA3725G high current NPN transistor arrays. Further devices will be added to the range in the near future and will include completely new devices as well as Gold Chip versions of established devices.

The new devices are called "Gold Chip" devices, the "Gold" signifying both high quality and the metal used in the final conducting layer. The new hermetic devices are manufactured at the RCA Plant in Findlay, Ohio. It is not intended that they should ever replace devices with conventional aluminium metallizing, since there are many applications in which aluminium corrosion is not a problem.

Testing

Samples of the new devices have been submitted to the Electronics Technology and Devices Laboratory of the US Army Electronics Command for testing at their tropical test centre, Panama Canal Zone. After nearly a million device operating hours, there has not been a single failure. The devices have also been tested in "pressure cooker" types of equipment where they are tested at high pressure and high temperature (202 kilonewtons/m^2 and 121°C for 250 hours). Again, there has not been a single failure.

Accelerated life tests thus far indicate a mean time before failure of about 30 million hours.

Applications

The new Gold Chip devices are ideal for use in mobile communications equipment, such as 2-way radio equipment for police, fire, military and forest patrol use. They are also suitable for use under the bonnet of motor vehicles where sudden temperature and humidity changes occur.

Other applications include marine equipment, portable instruments and control and monitoring equipment at unattended locations where weather conditions may be extreme.

PSST! . . . wanna buy a television receiver that you can put into your pocket? Or how about a portable colour model employing a single-gun colour tube? Matsushita has already developed these remarkable products, and will launch them onto the world market in the near future.

Remarkable new TV displays

Really small . . . LCD pocket TV receiver from Matsushita.

Two highly innovative TV receivers have been announced by Matsushita Electric Industrial Co Ltd, Japan. One is a pocket-size monochrome TV which uses a 6cm (diagonal) liquid crystal display (LCD) in place of a conventional cathode ray tube; the other is a portable colour TV using a single-gun, single-beam tube that has no shadow mask!

A shadow mask is an indispensable component in conventional 3-beam colour tubes.

Both new displays are compact in size and are designed for low power applications. Matsushita initially plans to use them in battery-powered portable TV receivers.

Marketing plans for the pocket TV with LCD have not yet been determined. Matsushita says it first plans to develop a more compact unit with even lower power consumption.

Single-gun, single-beam colour TV receivers for both NTSC and PAL systems have now been completed and, according to Matsushita, will be ready for export towards the middle of this year.

Pocket TV with LCD

The cigarette case-shaped pocket TV receiver measures a compact 118mm x 115mm x 34mm (L x W x D), and weighs in at just 640 grams. The new LCD flat-screen display is attached to the inside of the lift-up lid, measures 36 x 48mm, and comprises an array of 240 x 240 picture elements. Matsushita says that the number of picture elements, 57,600, is the highest ever for an LCD TV, and results in good picture quality.

Power consumption is said to be just 1.5W, and this allows three hours of continuous use with two lithium batteries (4.6V).

Matsushita claims to have solved the problems in conventional LCD display panels where the liquid crystal material is sandwiched by two electrodes and the scanning voltage applied one line at a time. The main problem here is that as the number of scanning lines is increased the voltage application time for each line becomes shorter, resulting in reduced contrast and response speed. Also, when the number of picture elements is increased, the drive circuitry becomes bulky and complicated.

Matsushita has solved these problems by sandwiching the liquid crystal between a front glass electrode and an IC array. The TV signals are temporarily stored in capacitors and then discharged to drive each picture element. High density mounting and low power consumption are attained by using CMOS ICs in the drive circuitry.

The concept of a "display IC array" is a major technical advance, according to Matsushita. Production of the array required a great deal of research and development effort, and resulted in the development of a new photo-process technology capable of integrating more than 110,000 elements onto a silicon substrate. These elements include the

Single-gun, single-beam colour TV tube without shadow-mask (left), and two 10cm colour TVs using the tube.

57,600 capacitors which correspond to each picture element.

The liquid crystal used in the new TV is of the dynamic scattering mode type, and is said to give a clear monochrome picture even when viewed at an angle. Other advantages of the LCD display include its low operating voltage and its excellent visibility in bright light.

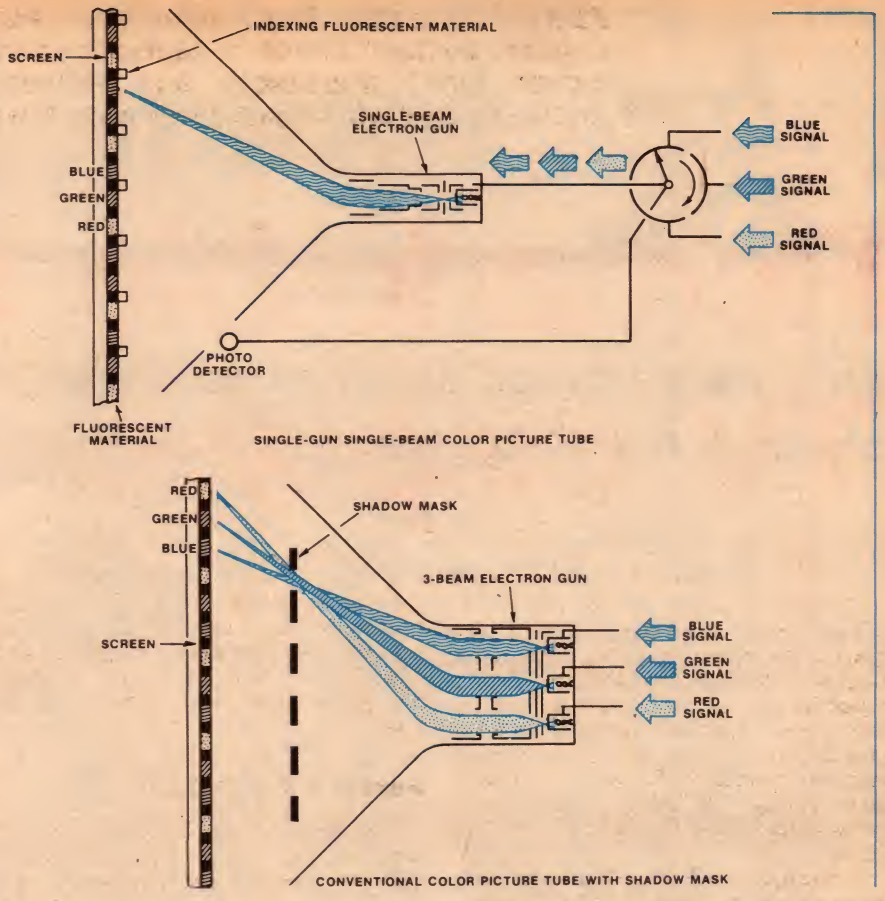
Single-gun, single-beam colour TV

Conventional colour TV receivers all employ a shadow mask in the picture tube — a thin steel plate which carries a pattern of holes or slots and which ensures that the beams from three electron guns strike the appropriate colour phosphors. This method has the disadvantage that power is wasted by the shadow mask (only about 40 per cent of the electrons get through the shadow mask), while the use of three separate electron guns increases power consumption even further and causes convergence problems.

Matsushita's new colour tube, on the other hand, uses only a single gun and has no shadow mask. Instead, the shadow mask is replaced by stripes of fluorescent material which emit ultraviolet light when struck by the electron beam. The emitted light is detected by a photomultiplier tube and the output signal used to multiplex colour information onto the single gun.

According to Matsushita, the single-gun structure reduces power consumption by about 40 per cent when compared to a conventional tube of the same size. Power drain of a newly-developed colour receiver employing the tube is only 7W, as against 12W for a comparable earlier model. A further major advantage of the single-gun structure is that it eliminates convergence problems.

Side-by-side comparison of compact TV displays. Colour receiver at right will be marketed later this year.



Basic structure of single-gun picture tube compared to conventional tri-gun tube. Indexing material is on back of black matric stripes.

Forum

Conducted by Neville Williams

They were worried about loudspeaker phase in the 1930's but . . .

The subject of audio signal phase has received a fair amount of attention during the past 12 months, but we find ourselves with a number of loose ends which it may be as well to tidy up. These range from one suggestion as to where it all began, to another which writes phase off as a non-issue!

The first suggestion, an historical reference, was brought to our notice by a reader H.S. of Bulimba, Qld, and is in the form of a photostat of pages 31 and 32 of "High Fidelity Techniques" by James R. Langham, Gernsback Publications Inc, New York, 1950. It refers, in turn, to a situation which obtained in early sound movie theatre practice, and which I retell, substantially as I've heard it through the years:

Around about the time that "talkies" were introduced, dynamic (i.e., moving coil) loudspeakers came into vogue and these made it possible for listeners, in both theatres and homes, to hear reproduced sound containing a substantial bass content.

Prior to that, with the old gooseneck horn and unbaffled cone speakers, bass had been implied rather than heard. With the arrival of dynamic speakers — and in a classic over-reaction — weight of bass became one of the criteria by which sound quality was judged!

Theatres were in a good position to give expression to this because they had — by the standards of the day — very powerful amplifiers, large and efficient loudspeakers, and a fair amount of room behind the screen to deploy loudspeaker enclosures. What should be more natural than to mount the woofer at the small end of a large, folded exponential horn with a mouth aperture large enough to stand in? Separate drivers, usually in smaller horns, were provided for the mid-range and treble.

The efficiency was high, the bass was ponderous and the sound on most material very impressive — again, by the standards of the day.

But there were some sounds that didn't fare too well: percussive sounds, like the tap dancing of Fred Astaire and his contemporaries. Apart from the problem of picture/sound synchronisation, the sound itself seemed to be dismembered, with the "click" obviously leading the "thump".

Here I must confess that I am relying entirely on what I have been told. My own experience of talkies during the period was largely confined to country situations, involving the local Mechanics' Institute and such places. There were no large horns and the audience had to grapple with more elementary acoustic problems: like subjectively differentiating between the sound from the loudspeakers and echoes bounced off the galvanised iron roof — or the noise of passing trains!

"You're right, you know. It certainly tightens up the phase response!"

However, in more "refined" situations, it was soon realised that the problem of Fred Astaire's hoofbeats arose from the very different path length for the high frequency components, compared with the bass energy working its way through a long, convoluted horn.

As Langham points out in the aforementioned textbook, the movie industry smartly settled for the alternative of a much shorter bass horn expanding rapidly from a large "throat" that often accommodated four 15-inch drivers. This greatly reduced the disparity in path length and in bass/treble timing or phase.

Again, according to Langham, quite a few private hifi enthusiasts (pre 1950) had to learn the same lesson. Their ponderous horns, built into the corner of the room, or down the unused chimney, were magnificent on some programs, but . . . and I quote:

"On organ records it isn't at all bad — the bass notes come booming out beautifully. But play that one section of Tchaikowsky's Fourth, with all the pizzicato strings, and it sounds crummy!"

In so saying, one can almost hear the cheers of the present day champions of linear phase loudspeaker systems — those units where the tweeter and mid-range units have been set back by a few centimetres to equalise the path lengths to the listener's ears. Seemingly, the observations dating back forty years or more, lend maturity and credence to what might otherwise be seen as the latest hifi fad.

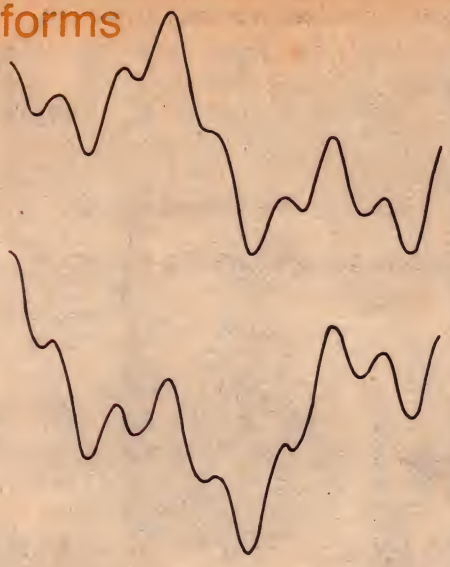
In fact, I doubt that they do. The historic situation concerns allegedly obvious effects arising from path differentials measured in feet; present day phase linear arguments are concerned with path lengths measured in inches (oops, millimetres) and effects which are, at most, extremely subtle. There is a huge difference in degree.

I am aware, of course, that in the April 1978 issue I recounted a demonstration set up Technics engineers in Osaka, which seemed to indicate that differences between high and low frequency drivers did produce an audible effect.

In conversation since then, quite a few audiophiles have re-echoed the reservations expressed in that article as, for example:

- In the test reported, a difference was observed using a square wave from a mono source in an anechoic chamber. It cannot be assumed that it would be apparent with program signal from a stereo pair in a normal room.
- Merely to note a difference does not mean that the respective sounds are right or wrong. Moving a microphone arbitrarily in a studio in relation to a sound source will also produce a difference!
- The phase relationship of audio signals suffers multiple arbitrary

Audio resultant waveforms



The waveform at the top is a copy of one specifically referred to in "HiFi Topics" elsewhere in this issue. The lower waveform results from shifting the instantaneous phase of the same three components. To the eye, the resultants have obvious differences; the as yet unresolved argument concerns whether such a difference is apparent to the ear.

variations along the complex chain between the mic. diaphragm and the amplifier output terminals. Why seek to preserve in the loudspeaker a relationship which is arbitrary, elsewhere?

While prepared to concede these very practical objections, our own attitude was to accept the phase linear concept as a technically valid step in the right direction, even though it may not be subjectively very significant at this point in time.

We finished up with a warning that: "A manufacturer who spends more money on a stepped enclosure and then compensates by using cheaper drivers might well effect an "improvement" sideways or backwards!"

Incidentally, in seeking to illustrate "HiFi Topics", and the spillover into these columns, we went a step further than usual and opened up a line of thought which I can't remember having heard expressed before.

Most observations and articles to do with phase involve square waves or other contours formed from harmonically related sine waves. In either case, the contour can be plotted or viewed on an oscilloscope, and does not vary with time.

Our own illustration was based on three waveform segments, with the centre one not harmonically related. When we asked our draftsman to fiddle the phases and produce another contour for purpose of illustration, he made the very valid observation that, with non-harmonically related waveforms, the contour would itself be constantly changing and would in fact, tend to be cyclic or repetitive. Any contour he might draw would be approximated naturally in due course.

And, when you think about it, the components in normal program material are never phase locked in the way they are from a square wave generator. Even in an ostensibly sustained chord, they will drift to form an ever-changing pattern. Can a listener really be expected to discern a specific change in a pattern that is, itself, subject to constant change?

Put like that, it would seem that, if phase is going to have any audible effect, it will be confined to transients, not of the "Fred Astaire" kind, but at the percussive leading edge of er . . . er . . . er . . .

In the light of all this, it was intriguing to hear a spirited reply to a question on the subject by Vice President of AR (Teledyne Acoustic Research), Herb Horowitz.

As reported in our last issue, Herb Horowitz was in Sydney to explain and demonstrate his company's current line of loudspeaker systems, including the new AR-9 designed to be "the best speaker in the world". But the AR family is noticeably flat faced, as compared with the protruding chins of many of their phase-linear rivals.

How come?

According to Herb Horowitz, Teledyne engineers made a special study of papers on the subject and discovered a basic flaw in the maths. The engineers were keen to make a "big deal" of their discovery but were restrained by AR management on the grounds that prizes are not awarded for being negative! However, Herb Horowitz indicated that the word had got around and that we could expect to see some of the champions of phase linear loudspeakers backing off from their earlier attitudes.

It will be interesting to see whether this does, indeed, happen!

One other observation about phase relationships flows from the "HiFi Topics" feature elsewhere in this issue. In constructing a resultant from three sine waves, and talking about preserving that resultant, I made the deliberate decision not to complicate the discussion by bringing in the subject of phase.

In fact, by simply shuffling the phase relationships of the components relative to one another, the original contour of Fig. 1d becomes something quite different, as indicated.

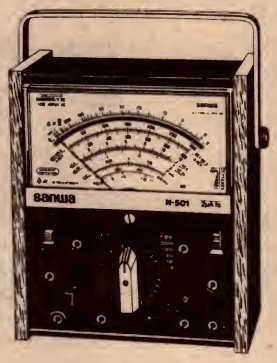
Phase shifts of this kind will occur along the recording and amplifier chain, if only because frequency conscious networks and processes are involved. For this reason, if for no other, the groove tracing on a mono, lateral disc will be an audio resultant

REAL POWER LINE UP

sanwa

AX-303TR

44μA meter movement — Si diode protection against pulse input.
Measures hFE (0-1000) by using the extra connector.



N-501

2μA suspension movement — 0.05mA/1mV resolution.
Double protection — fuse & Si diode.
Constant 1MΩ input impedance (ACV) — RF-diode rectified current direct to movement.

BX-505

Fast-response, 24μA movement — fuse & diode protected with high resolution factor. (0.4μA/scale division)
Revised scale marking — intermediate readings readily determined.

U-60D

44μA movement — quality performance, diode protected.
Temperature measurement of −30°C to +150°C with extra scale.

CAM-250D

Clamp meter
Economical and multi-function. Single motion core arm.
Compact yet provides 4 ranges on ACA and 2 ranges on ACV.

PDM-500/C

Performs as low resistance ohmmeter besides insulation tester.
Measurement, scale calibration and battery check are all operated by pushbutton switches.
Has constant voltage impressed irrespective of the value of resistance checked.

N-501

● ±DCV 0-60m 0-0.3-1.2-3-12-30 0-120-300-1.2k-30k (w/HV probe) ● ±DCA 0-2μ 0-0.3-0.3-1.2-3-12-30m 0-0.12-0.3-1.2-12A ● ACV 0-3-12-30-120-300-1.2k ±2.5% Freq. 20Hz to 50kHz ● ACA 0-1.2-12 ● Ω x 1-x10-x 100-x 1k-x 10k-x 100k (max. 200M) Batt. 1.5V x 1 & 9V x 1 ● dB −20 to +63

AX-303TR

● ±DCV 0-0.3-3-12-30-120-300-1200 ● ACV 0-6-30-120-300-1200 ● ±DCV 0.60μ -3m-30m-0.3-12 ● Ω x 1-x 10-x 1k-x 10k (max. 20M)

U-60D

● DCV 0-0.1-0.5-2.5-10-50-250 -1k-25k (w/HV probe) ● DCA 0-50μ -2.5-50-500m ● ACV 0-2.5-10-50-250-1k ● Ω x 1-x 10-x 100-x 1k (max. 5M)

BX-505

● ±DCV 0-0.12-3-12-30-120-300-1200-30k (w/HV probe) ● ±DCA 0-30μ -3m-30m-0.3-12 ● ACV 0-6-30-120-300-1200 ● ACA 0-12 ● Ω x 1-x 10-x 1k-x 10k (max. 20M)

CAM-250D

● ACA 6-30-60-300 ● ACV 300-600 ● kΩ 0-50k ● Batt. 1.5V x 1

PDM-500/C

● V/Ω rated 500V/100M ● Scale range 0-0.1-100-200m (1st effective scale range underlined) ● Ω 0-100Ω ● Power source AM or UM-2 x 3

WARBURTON FRANKI

● ADELAIDE 356-7333 ● BRISBANE 52-7255 ● HOBART 23-1841
● MELBOURNE 699-4999 ● PERTH 277-7000 ● SYDNEY 648-1711
● AUCKLAND N.Z. 79-7781 ● WELLINGTON N.Z. 698-272

FORUM — continued

waveform but not necessarily of the same visual shape as at the amplifier input.

Ideally, I suppose, after all the fiddling in the recording and amplifier chain, the ultimate output waveform should be the same as the original input, with components, amplitudes and phases restored to the original relationship. But that's really what the argument is all about.

The traditional view, supported by a wealth of traditional research is that the ear is sensitive to frequencies and amplitudes but not to relative phase; that changes in contour, shown up by plotting, or as depicted on an oscilloscope are purely visual, with no auditory significance.

But the phase linear proponents think otherwise. And that just about brings us back to where we were in April last!

"NOISE FREE" RADIO

To change the subject, we reproduce the letter below from a New South Wales reader, concerning car ignition hash and FM radio.

The whole subject was raised by a correspondent J.R. in the September issue and, as noted above, mentioned further in December.

J.R. was concerned because his reception of FM/stereo, in an ostensibly reasonable location, was bedevilled by ignition interference from passing cars. We tended to blame his antenna or his tuner but left the matter open with the thought that other readers might have similar problems. If they have, they have been remarkably reticent, remarks being confined to FM interference problems in vehicles.

We'll leave that subject open, too, to see what comes out of it but, in the meantime, I note T.B's reference to antenna polarisation.

Early in the piece, the now defunct Australian Broadcasting Control Board adopted the guideline for FM that the transmitted signal should have the same polarisation as had already been set for television stations in the relevant areas. This meant horizontal for most places, but vertical in a few others, and notably in Canberra.

It seemed a fairly routine decision at the time, with the conveniece that listeners could take a split from the TV antenna to feed the FM tuner.

More recently, it has become apparent that the majority of FM receivers in use will be portables and car radios, in every case with a vertical whip. About the worst signal you can provide for them is one that is horizontally polarised! Yet to standardise on vertical polarisation would be to disadvantage users of more elaborate equipment operating from a TV or TV-style antenna.

The seemingly obvious course is to standardise on mixed polarisation for all FM stations in Australia, with signals having both a vertical and a horizontal component. Based largely on overseas experience, it would appear that circular polarisation is the best all round proposition, giving the listener the choice of either a vertical or horizontal antenna, or a more complex unit designed to take full advantage of the signal.

The problem seems to be that the present administration hasn't yet got around to confirming a standard based on local findings. In the meantime, we're likely to end up with a true mixture of polarisation, with some stations following the old guidelines and others, with departmental acquiescence, taking a punt on circular!

The way things look at present, the answer will be established by practice and confirmed officially mush later.

More about ignition hash and FM

Dear Sir,

I read with interest, in your December edition, Mr William's article about "FM AND IGNITION HASH" and the letter from Mr N. H. about Melbourne problems in mobile FM reception.

As I have been involved for a long time in car radio and car interference suppression development, I felt that I should add a few words.

It is true, that interference was almost an insurmountable problem when FM reception was first introduced into mobile applications. The car wiring and even the chassis and the body are very effective radiators and re-radiators around 100MHz. Metal panels, which shield effectively on medium wave lengths become vicious interference sources and aerial cables if not terminated with the correct characteristic impedance can add to the difficulties.

Even so, with a lot of care and time, and fully understanding the sources, any car can be made interference free while it is alone on the highway. As soon as another car approaches the whole procedure is wasted!

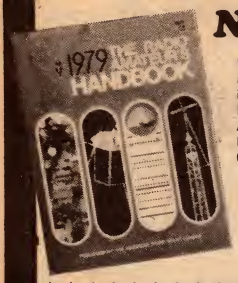
This has been realised by quite a few FM radio manufacturers and several methods were developed which solve this problem by selecting out the offending pulses and cancelling them by phase reversion. The electronics is involved but still far more simple than the microprocessor controlled car radios, which soon will appear on the market, and it works very well.

These devices are sold either as additional suppressors or are built into better products. As with most devices these days, they exist as an integrated circuit (monolithic or thick film) and are modestly priced. The surprising fact is that Mr N. H. does not know of these suppressors, because for every practical reason they render the interference problem non existent.

Unfortunately the polarisation problem is still with us; most of the FM transmitters in Australia are horizontally polarized. The car radio manufacturers requested the ABC several times to change to mixed polarization but with no result. The polarization problem emphasizes the multipath problem (this is for some reason worse in Melbourne than in Sydney) which sometimes can mar good stereo reception in moving vehicles. Again special care in ratio detector design can help quite markedly, but in certain areas the receiver has to be switched back to mono reception.

T. B. (St Ives, NSW)

ARRL AMATEUR RADIO HANDBOOK - NEW 1979 EDITION



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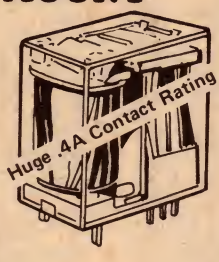

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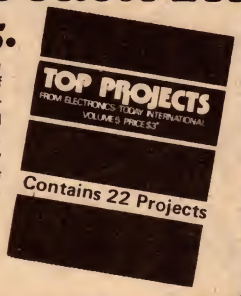
Expansion board (See EA Nov. 1978 p70)
PC Board 78uP9 .. Cat. H-8358 .. $5.60
8K RAM board (See EA Dec. 1978 p83)
PC Board 78uP10 .. Cat. H-8359 .. $5.50

TOP PROJECTS FROM ETI - VOL. 5.



Brand new and fantastic as always - the Electronics Today International Book of Top Projects (Vol. 5). Contains constructional details of many interesting and useful projects, e.g. Graphic Equalizer, Shutter Speed Timer, Dual Power Supply etc, etc. Add this superb volume to your shelf and improve your knowledge of electronics.

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Dick has purchased a quantity of the MM5314 clock chip as used in the 6 digit clock (See EA Febuary 1979). This prime spec. device is from National Semiconductors and represents fantastic value.

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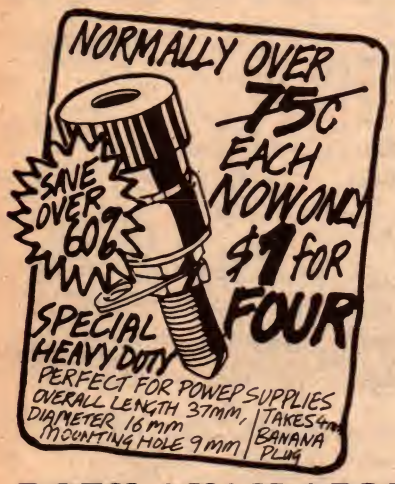

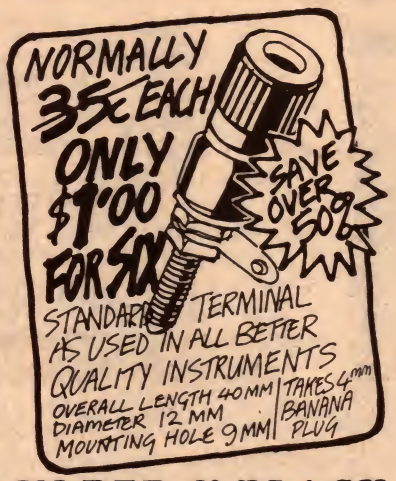

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PARTS FOR MAGAZINE PROJECTS

6 DIGIT CLOCK (See Feb. EA)

Complete kit, including instructions	Cat. K-3495 $19.75
Case with mounting bracket and bezel	Cat. H-3194 $3.60
AC Mains adaptor	Cat. M-9514 $5.25

PLAYMASTER AM/FM TUNER (See Nov/Dec EA)

Complete kit, including instructions	Cat. K-3494 $159.50
SEPARATE PARTS	
Pre-wired and aligned tuner module	Cat. F-4610 $59.00
Set of 4 PC boards	Cat. H-8357 $9.75
Signal strength meter	Cat. Q-2100 $4.95
Tuning meter - centre zero	Cat. Q-2095 $4.95
Most other electronic parts for this project in stock.	

MODEL TRAIN CONTROLLER (See Oct EA)

Not produced as a kit - all parts available from stock:	
PCB only	Cat. H-8355 $3.75
Zippy box	Cat. H-2752 $3.75
2N3055 transistor	Cat. Z-2145 $0.95
2N3053 transistor	Cat. Z-2130 $0.80

FET INPUT AC-DC VOLTMETER (See Sept EA)

Not produced as a kit - all parts available from stock:	
PC board only	Cat. H-8353 $2.75
1mA MRA-65B panel meter	Cat. Q-2060 $12.50
Fabricate your own meter scale using the Scotchcal process:	
8005 black Scotchcal photo-sensitive aluminium	Cat. H-5694 $6.00
CA-3140 FET op-amp	Cat. Z-5417 $2.50

VARI WIPER Mk 2 (See Sept EA)

Not produced as a kit - most parts available from stock:	
Relay	Cat. S-7125 $4.80
C106YI SCR	Cat. Z-4315 $1.00
2N2646 (DS2646) unijunction	Cat. Z-1786 $1.20

UPGRADED 40/200MHz FREQ. COUNTER (See Aug EA)

Same style as previous kit, but new circuitry means it is easier to build, set up and is more sensitive. Basic counter is 40MHz - by adding a single 95H90 IC the range is extended to 200MHz.

Complete kit for 40MHz, inc. instructions	Cat. K-3437 $99.50
96H90 IC to extend range to 200MHz	Cat. Z-5360 $12.50
SEPARATE PARTS:	
PC boards (set of two high quality boards)	Cat. H-8346 $8.50
MC-1016L IC (triple differential amplifier)	Cat. Z-5415 $1.95
MM-5369M IC (oscillator - divider)	Cat. Z-5781 $2.50
74C926 IC (4 digit counter)	Cat. Z-5414 $6.50
3.579545MHz crystal (new low price)	Cat. K-6031 $3.00
LT-303 7 segment display	Cat. Z-4103 $1.50
All other components are normal stock lines at all of our stores.	

PHOTO TACHOMETER (See Aug EA)

Although we do not produce a full kit for this project, all parts are normal stock lines at all of our stores.

PCB (only)	Cat. H-8352 $1.80
FPT 100 phototransistor	Cat. Z-1950 $2.00

NEW 10-GAME TV GAME KIT (See July EA)

Complete kit, including instructions	Cat. K-3491 $49.50
SEPARATE PARTS	
PCB (only)	Cat. H-8344 $3.95
Fully built RF modulator	Cat. K-6040 $3.00
Fully built audio modulator	Cat. K-6042 $4.50
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Many other PC boards for current magazine projects in stock.

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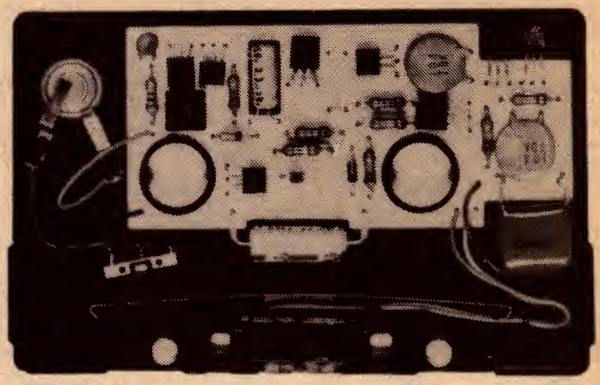
Elektron 2000	44 Brown Road, Newcastle NSW. Ph 691 222
GM Electronics	99 Fitzmaurice St, Wagga NSW. Ph 21 3044
Trilogy Elec Supplies	40 Princes Hwy Fairy Meadow NSW Ph 83 1219
Crystal TV Rentals Pty Ltd	66 Crystal St, Broken Hill NSW Ph 6897
Lismore Kitronics	Magellan St & Bruxner Hwy Lismore NSW Ph 878 361
Langman's Sound Centre	Shop 15, Treasure Island, Coffs Harbour Jetty NSW Ph 521-570
Sumner Electronics	95 Mitchell Street, Bendigo VIC Ph 43 1977
Citcom Electronics	Hopkin's Arcade, West St, Mt Isa QLD. Ph 434-791
ADS Electronics	312 Oxley Ave, Margate QLD. Ph 204-1276
Advanced Electronics	5a The Quadrant, Launceston TAS. Ph 31-7075
Aero Electronics	123a Bathurst St, Hobart TAS. Ph 34-8232
Hutchesson's Comm. Centre	5 Elizabeth St, Mt Gambier SA. Ph 256-404
Gawler CB Centre	51 Hillier Road, Evanston SA. Ph 222-149
Altronics	105 Stirling St, Perth WA. Ph 328-1599
Hocks TV Rentals	87 Hannan St, Kalgoorlie WA. Ph 211-906

TDK's Revolutionary New Product — The HD-01 Head Demagnetizer Built into a Cassette Shell.

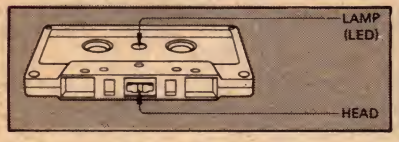


Simply load the HD-01 into any cassette recorder as you would a standard audio cassette and depress the 'play' button.

The HD-01 Head Demagnetizer was designed by TDK for easy, convenient head demagnetization of any cassette deck, insuring crystal-clear, perfect recordings every time.

The TDK HD-01 Head Demagnetizer features:

- A unique cassette format, designed to insure complete compatibility with any cassette deck.
- Powerful de-gaussing circuit instantly demagnetizes recorder heads the moment the play button is depressed. The above diagram depicts the oscillating waveform applied to the recorder heads, removing every trace of residual magnetism in only one second!
- A red LED (Light Emitting Diode) built into the HD-01 cassette shell will light up the moment your recorder heads have been completely demagnetized.



The TDK HD-01 Head Demagnetizer ends forever the fuss and mystique surrounding the demagnetization process and is much easier to use than conventional wand-type tools. Anyone can use the HD-01 and get perfect results every time.

The TDK HD-01 Head Demagnetizer is completely self-contained, battery operated and portable. It can be taken anywhere and stored with your present audio cassettes. The TDK HD-01 is ideal for all types of cassette decks especially those with heads located in hard to get at places such as:

- recorders with heads positioned in the front of the unit but which point to the rear.
- those with 'pop up' loading mechanisms which can not be detached, thus making the heads almost inaccessible.
- cassette decks with heads positioned laterally with respect to cassette loading (car decks are good example of this type).
- automatic loading machines.

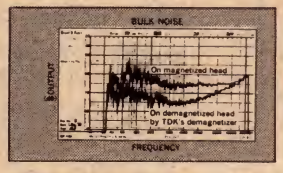
WHY IS DEMAGNETIZING SO IMPORTANT?

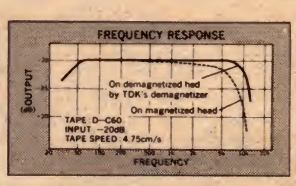
TDK, in conjunction with many cassette deck manufacturers, recommend that cassette decks be maintained on a regular basis. Cleaning the heads, capstan and pinch rollers is one important aspect of that maintenance program. — Periodic demagnetizing, about every thirty hours of use, is the other. Failure to do so will cause a build-up residual magnetism on the heads, which can seriously affect tape and machine performance in the following critical areas:

1. The noise level in the low and midrange frequencies is increased by 5 to 7dB, thereby reducing the overall signal-to-noise ratio.
2. Pre-recorded tapes can also be affected with midrange and high frequency distortion, as well as attenuation by as much as 2 to 6 dB, virtually eliminating any hopes for clear sound reproduction.

The interaction of these factors will not only prevent both the tape deck and tape from displaying their true performance capabilities, but will severely limit the Dynamic Range properties of both, rendering pure sound reproduction an impossibility.

The following comparison data clearly demonstrates the effect of residual magnetism on recorder heads in the areas of both Noise Level and Frequency Response.





TECHNICAL DATA

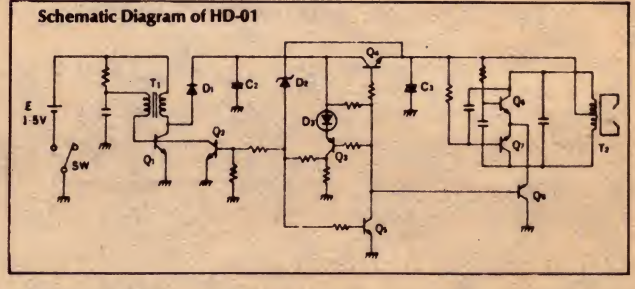
Major Components:
Transistors (8)
Diodes (2)
LED (Light Emitting Diode)

Power Supply – Control Section – Oscillation Section – Head Section

Specifications:

Maximum Magnetic Flux Density	200 Gauss
Oscillation Frequency	630 Hz
Shape	(External Dimensions) Conform to IEC Standards
Battery for Power Supply	G-13 1.5 volt, Silver Oxide Battery (option)

Schematic Diagram of HD-01



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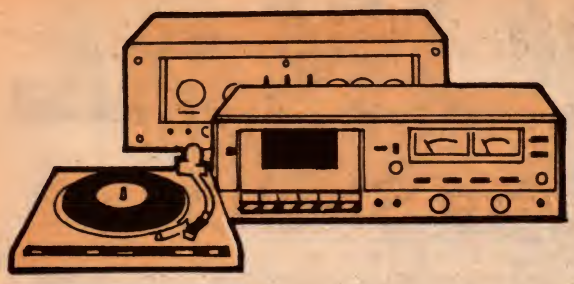

Hi Fi Topics

DIGITAL RECORDING: DIRECT CUT QUALITY WITHOUT THE HASSLE

Slowly but surely, pulse and digital technology is invading the audio-hifi area, traditionally an analog stronghold. This article explains something of the background and refers in particular to the application of digital techniques to the master recording chain.

by NEVILLE WILLIAMS

Rather than launch straight into a discussion of the digital system, it may be helpful first to recall the kind of waveforms involved in a conventional audio signal; then to look at the pulse concept and finally the full digital approach. First, the audio signal:

Fig. 1a shows a basic audio sinewave. Looking at it, the average enthusiast will have no great difficulty in imagining a stylus, or a voltage, or a loudspeaker cone oscillating in this simple mode. For purposes of illustration, it is probably too simple!

Actual program material is far more complex and, in the ultimate, can be analysed into a very large number of sine waves, present simultaneously and making up the total sound. It is rather difficult to visualise a stylus, or an amplifier, or a loudspeaker cone responding to them all at the one time.

Fortunately, however, the situation can be illustrated graphically,using a practical number of signals.

Let's say that, to the simple sine wave of Fig. 1a, we add two others (b) and (c), variously related in terms of amplitude and frequency. Adding them together arithmetically produces the complex resultant (d).

Without getting too pedantic, if the three signals (a), (b) and (c) were present in the studio at a particular instant, the resultant pressure wave adjacent to the diaphragm of the microphone might look something like (d). So also would the movement of the diaphragm, plotted against time, and the variation in the microphone output voltage.

Nor is Fig. 1d the mere creation of a draftsman. The track on an ordinary lateral cut mono disc is virtually the graph of an audio resultant (like 1d) inscribed in vinyl!

Ultimately, a recording and amplifier system has to preserve and recreate just such a complex resultant pressure wave in the listening room, so that it causes a corresponding movement of the "drum" in the listeners' ears. Thereafter, the listeners' audio sensing faculties sort the complex wave (Fig. 1d) back into its original frequency components (a), (b) and (c).

Traditionally, audio equipment has operated on an analog basis. The tiny signal from a microphone is passed through amplifiers which deliver an output, larger in amplitude, but closely related to the original in contour. Each tiny variation in input is matched by a proportional variation in output.

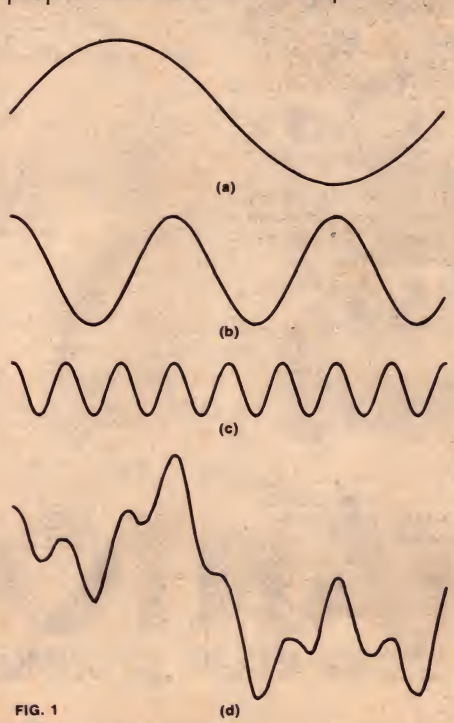

FIG. 1

Showing how the multiple components in a complex signal (a), (b) and (c) combine to produce a resultant (d), which is the kind of waveform which an audio reproducing system has to handle.

A prime requirement of a hifi recording and amplifier component (or system) is that it should exhibit a linear transfer characteristic, such that the output (although amplified) is a replica of the input. If it is not so, the component or system has introduced distortion of one kind or another.

No practical equipment is completely free from distortion, but the efforts of designers through the years have brought about a quite dramatic progressive reduction in its overall percentage level. However, sound engineers have to worry about more than just distortion.

In some ways a more urgent problem is the intrusion of system noise upon the wanted signal. Every segment of a reproducing system introduces some spurious noise, evident on otherwise pure musical tones. Under the most favourable conditions, noise may be so low as to be virtually indiscernable during ordinary listening; under poor conditions, it may be distractingly evident.

Because noise is most apparent during soft passages or breaks in music, it is one of the factors which determines the "dynamic range" of an audio module or system: the difference between the intrinsic noise level and the signal overload level.

By way of illustration, the dynamic range of a good/average quality pre-recorded cassette is about 50dB; a good/average disc is usually somewhat better at about 60dB. To cope effectively with demanding program requirements, a figure approaching 80dB would be more appropriate, indicating an obvious present-day problem area.

In fact, the level of noise — and distortion — apparent in pre-recorded cassettes and discs is not necessarily inherent in the piece of tape or vinyl that the consumer actually buys. A

PROFESSIONAL

Ohio Disco Packager, SWB Electronics, uses Stanton Exclusively.

Larry L. Decker, Designer/Owner, examines finished control table for Disco use.

The trend to Portable Disco continues strong. An ambitious Company in Canton, Ohio, SWB, is achieving excellent success with their units (their goal is a national franchising operation). James C. Fravel, General Manager/Promotions, writes to Stanton, "We use Stanton cartridges in each and every unit we sell. Two of our units have been running for about a year and a half without failure. We are proud of the track record of our units and the Stanton cartridges."

They use the 500AL because it's a durable cartridge and "gives SWB a 4 dB base boost that we like to have with the music we play. It has been, by far, the best cartridge we have used (and we have tried many)".

So, Stanton, world famous for its top-of-the-line calibrated cartridges, the 881S and the 681 series, also serves the professionals in the Disco Industry.

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significant proportion is a heritage from the signal processing further back in the chain.

By the time the source signal has passed through the mixing console onto multi-track tape, been edited, compensated and mixed down to a stereo master, dubbed for distribution to licencees, dubbed again to produce factory masters and so on, quality has inevitably been compromised.

This is one of the reasons why "direct cut" discs have found so much recent popularity: discs where the signal has been fed direct to the disc cutter, without the intrusion of tapes and dubbings.

But direct cut discs pose many problems: the strain on the performers; the inability of engineers to "rehearse" the cut; the risk of repeated failures; the lack of variable pitch facility; the inability to cut at half speed; the limited production run and the resulting price disadvantage. And so on.

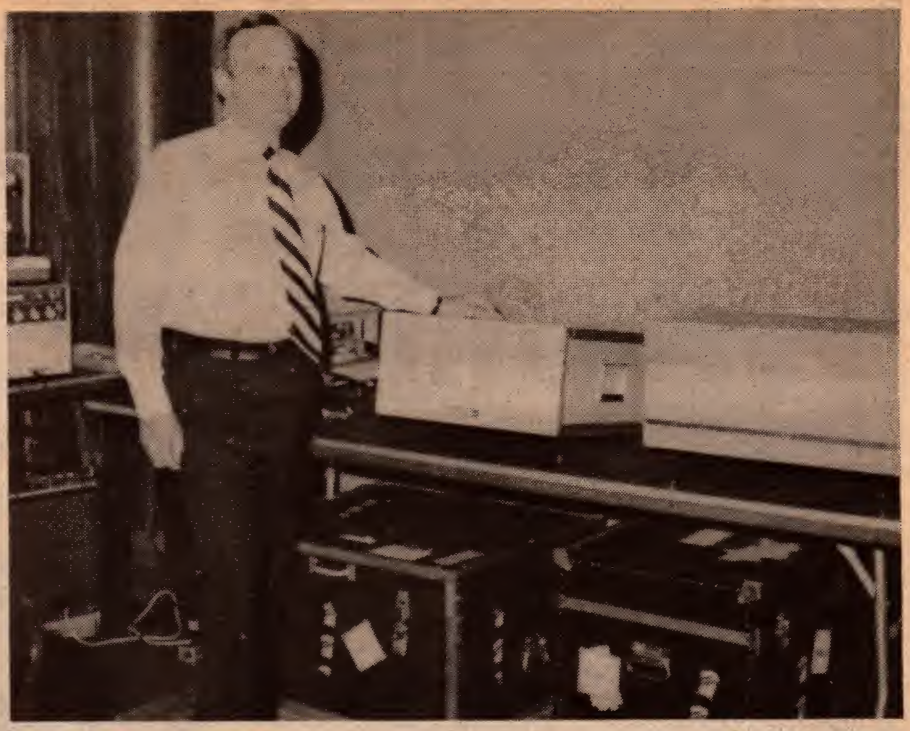
Recording engineers have adopted many measures in an effort to contain the noise and distortion problem while still retaining the advantages of tape mastering, and it is probably true to say that, under the best conditions, many such measures yield gratifying results. The problem is that the margins for error are too small and companies are too frequently obliged, by commercial necessity, to release recordings which are merely average in quality.

Digital recording technology holds firm promise of a way around these difficulties, offering the conveniences of tape mastering, without a significant retreat from the potential quality of direct cut.

The digital approach is a combination of computer technology with audio pulse techniques. To gain an appreciation of the latter, we should go back to Fig. 1d — the kind of complex waveform which any audio system has to preserve and reproduce.

Whereas the analog approach is to respond directly and continuously to every tiny convolution of the complex waveform, pulse technology relies on "sampling". Special circuitry, gated at a very precise "clock" frequency, samples, and measures the amplitude of the audio wave at short intervals and produces a train of pulses, which vary in one way or another, according to the audio content.

Having been translated into pulses, the one-time audio signal is processed and/or recorded using modern pulse technology. At some later stage, the pulse information is translated back into analog form, suitable for recording on to present-day discs or tapes and for reproduction through conventional hifi systems.



Dr Stockham with the Soundstream digital recorder mentioned in this article.

Whatever the purpose and mode of such manipulation, it leads to an obvious objection: if the contour of the complex wave is so sacrosanct, how can it possibly survive being reduced to a sequence of tiny, isolated samples? Surely the recovered waveform must be a mere approximation of the original, lacking fine detail and therefore containing significant distortion?

This would, in fact, be the case, if certain basic requirements were not met.

The first relates to the sampling frequency, which must be at least twice the highest audio frequency component which it is desired to retain in the signal being processed. Thus, for a top audio frequency of 15kHz, the sampling frequency must be not less than 30kHz.

In practice, a high quality system would more likely use a sampling frequency nearer 50kHz. This provides a margin on potential bandwith and also ensures that the sampling frequency can be filtered out effectively from the analog signal, when the latter is finally reconstituted.

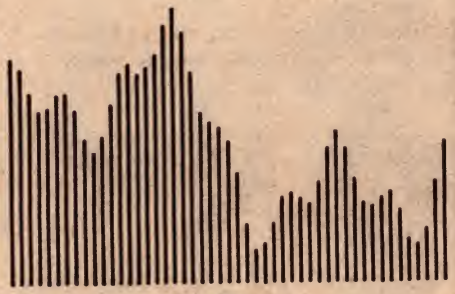


FIG. 2

Using pulse technology, complex audio waveforms are translated into, and recovered from, a long train of pulses, which are encoded in some way to indicate the instantaneous signal voltage which each represents.

A further requirement is that the means of describing the height of each sample pulse must itself be accurate and not subject to significant cumulative error. If it were suspect, the recovered waveform would be subject to distortion and the whole exercise would be rendered futile. More about this later.

A possible interference flowing from Fig. 2 is that the pulses are equally spaced and of equal width but of a height directly related to the waveform. In fact, such a train of pulses would be said to be amplitude modulated and described by the letters PAM (Pulse Amplitude Modulation). Indeed, because the pulses are amplitude modulated and still so obviously related to the original waveform, the method falls into what is sometimes referred to as a "quasi pulse system".

A different approach, which is more representative of true pulse technology is to so arrange the analog-to-pulse conversion that height and frequency remain constant but the pulse width varies in proportion to the signal amplitude. This is referred to as PWM (Pulse Width Modulation).

A still further method is to keep the pulse height and width constant but to vary the position of the pulse according to the analog waveform. This is called PPM (Pulse Position Modulation).

In fact, the method which holds so much promise for master recordings goes well beyond any of these into full digital techniques. As each individual

sample of the complex waveform is taken, its amplitude is measured electronically and translated directly into a row of binary digits, which can be processed by computer style circuits and memories, and stored on tape as computer-style data.

In short, the system does not store and process audio waveforms at all, or even pulses modulated in one or other of the possible ways. It simply stores a series of numbers indicating the amplitude of successive samples. At a later point in time, the "measurements" of the complex waveform, encoded by an A-D (Analog to Digital) converter can be utilised by its D-A (Digital to Analog) counterpart to reconstruct a closely equivalent waveform.

However, those familiar with digital technology will see one immediate objection. While in one sense capable of high accuracy, digital systems can deal only with discrete numbers. Therefore, in turning an analog waveform into data, there will inevitably be some approximation, with the last digit rounded off.

The answer to this problem lies simply in having a sufficient number of binary digits, or "bits" in the measurement code. For example, a 16-bit code can specify 65,536 voltage levels in binary numbers, ranging from: 0000 0000 0000 0000 to 1111 1111 1111 1111.

One scarcely needs to be a genius, of course, to realise that a large number of "samples" each involving a large number of "bits" must add up to a very substantial "bit rate" or bit frequency. Thus 50,000 samples per second, each with 16 binary bits would work out at 800,000Hz, or just on 1MHz — all for one audio signal. However, with the bit rates involved in modern computer technology, and with even home video recorders handling a signal several MHz wide, the need for a 1MHz facility to handle an audio signal is of no great consequence to a recording engineer, if it confers other advantages.

Digital recordings impress with quality, dynamic range

THE FIREBIRD SUITE (1919). Stravinsky. OVERTURE and POLOVETSIAN DANCES, Borodin. Robert Shaw and the Atlanta Symphony Orchestra. Telarc stereo, Digital, DG-10039. (From speciality record stores or direct from P.C. Stereo, PO Box 272, Mt Gravatt, Qld 4122. $19.50 post paid.)

First reaction, in slipping this disc out of its cover, is that side one in particular is only half utilised, with plenty to spare outside the lable. Yet there are about 21 minutes of program on each side. The reason lies simply in the very wide dynamic range, which has allowed the recording engineers to record the lengthy softer passages at a very low level, with minimal spacing between the tracks.

But I was forewarned by the sight of other, narrower segments where the grooves are obviously very widely separated and very heavily modulated. Indeed, I sampled these first, set the amplifier gain for an acceptable maximum level, then started at the beginning, leaving the controls thereafter untouched.

And the dynamic range is every bit as wide as it looks, with a weight of bass that is nothing short of electrifying. Yet it is completely clean, although it may easily distress anything but a compliant cartridge and a good speaker system. It makes one wonder how much deliberate compression or accidental "crushing" operates in a normal studio analog tape system.

For the rest, the general quality is excellent and, in this respect fully comparable with other top-of-the-line discs, produced by whatever process. The whole point, however, is that this remark can be made alongside an observation, about extremely wide dynamics and a massive sound from the drum department.

Recorded only in June 1978, the album is an import in a generous double-fold jacket, with notes on the digital recording system, the orchestra, the conductor, the music and the composers.

Concerning the performance, I think you'll find it well up to expectations and, provided the music appeals, it will let you enjoy and experience what modern digital recording is all about. (W.N.W.)

☆ ☆ ☆

HOLST: Suite No. 1 in E-flat; Suite No. 2 in F. HANDEL: Music for the Royal Fireworks. BACH: Fantasia in G. Frederick Fennell conducting the Cleveland Symphonic winds. Telarc digital stereo No. 5038. (From specialty record stores or direct from P.C. Stereo, PO Box 272, Mt Gravatt, Qld 4122. Price $19.50, post paid.)

The remarks made about the "Firebird" album apply equally to this one: 20 minutes or more on each side, with track spacing giving a clear visual clue to the wide dynamic range.

In fact, there is a statement in the specifications of this disc to the effect that absolutely no limiting, filtering, compression or low frequency cross-over is used and that the effective dynamic range is at least 20dB greater than is found on normal commercial discs featuring the same works.

The manufacturers further warn that it is an "audiophile" recording, intended to be played on equipment with intrinsically low noise and capable of handling large groove amplitudes. And I can assure you that that's the way it sounds!

The 60 or so wind and percussion players — half of them drawn from the Cleveland orchestra — offer a superb performance, matching the quality of the engineering.

If your cheque book will stretch only to one of these records, buy the one which appeals in terms of program content. Technically they both illustrate well the potential of the digital mastering technique, with its clean sound, wide dynamic range and massive bass.

Like the "Firebird", this one carries the endorsement on the double fold jacket "Imported pressing". The notation is actually for the benefit of US audiophiles and confirms that it was manufactured overseas from American digital tapes. As before, the jacket contains complete notes on everything from the system to the composers. Another good one. W.N.W.)

STOP PRESS

CONSUMER REPORT MAGAZINE RATE MARANTZ HIGHEST ACCURACY SCORE IN HIGH PRICED LOUDSPEAKERS!

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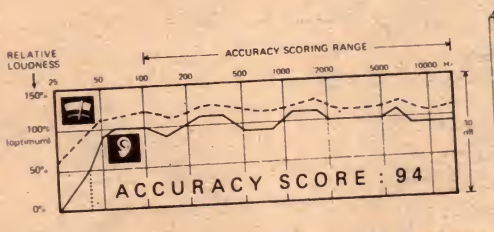

MARANTZ HD880
40¼ x 16 x 13¾ in. 62 lb. Bass half-loudness point: Very good (40 Hz). Freedom from bass distortion: Better than average. Power range required: 25-60 watts. Impedance: 4 ohms. Comments: Has very-high-frequency level control. Has removable bass-port plug to increase bass (see story). Had highest accuracy with tweeter control set at ¾ of maximum, other controls set at maximum, and bass-port plug in.

Competitive Speakers	Accuracy Rating
ESS AMT 1B	93
YAMAHA NS69011	92
AR 10 π	90
EPICURE 400	90
ALTEC MODEL 15	89
DAHLQUIST DQ10	89
JBL L166	89
PIONEER HPM 100	89
JENSEN 550	88
EV INTERFACE C	87
ADS 810	86
INFINITY QUANTUM 5	86
BOSE 901 SERIES 111	85
KLIPSCH HERESY HWO	83

The Report, which was prepared by the highly respected American organisation, Consumers Union, combined computer and laboratory measurements with expert listening tests to show that Marantz HD880 was the most accurate in a group of 14 highly regarded Hi Fi Loudspeakers.

"In CU's view, the most meaningful single standard for judging loudspeaker performance is accuracy - a speaker's ability to reproduce sound energy smoothly and uniformly over the entire musical spectrum. The higher a speaker's accuracy, or fidelity, the more fully it can respond to the entire spectrum of musical sound, from the tinkling of a triangle to the deepest tones of an organ."

But the sad truth is that most speaker manufacturers have given up on the accurate loudspeaker. Instead, they produce models with booming bass, sizzling highs and great vocal presence, and call it "personality". Trouble is, that "personality" doesn't come from the music at all, but from shortcomings in speaker design that actually distort sonic accuracy and create coloration.

Marantz chose instead, the more formidable task of working to yard a loudspeaker which is as accurate as theoretically possible. When you combine accuracy with Marantz quality, YOU HAVE A WINNER.

FULL COPIES OF REPORT AVAILABLE ON REQUEST

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HIFI TOPICS: Digital Recording — continued

Using such a code, it is possible to record and reproduce a complex waveform audio waveform at least as accurately as by the best analog techniques, but with a much wider dynamic range — in excess of 90dB.

This means that a recording engineer can commit a performance to tape without the need for any signal compression or anit-noise processing, and recover it with virtually no more distortion or noise than was inherent in the original microphone and console system.

What is more, if he needs to dub or mix down from the multi-track digital master, he can do so with virtually no cumulative deterioration, as long as the signals remain in digital form. He is simply merging data in a computer style operation.

Provided the digital circuitry does not malfunction — and there is no special reason why it would — a long series of numbers describing a waveform will remain intact, no matter how many times it is copied. And that simply means that the waveform, as reconstructed, will remain intact, free from added noise or distortion.

Another important advantage is the opportunity to avoid wow and flutter during such processing.

During the original recording session, the timing of the samples is dependant entirely on a pulse generator or "clock", which can be as precise as the engineer cares to arrange for. During replay, he does not have to accept the samples as they flow from the tape, as with a normal analog system. The pulses can be fed into a memory buffer and subsequently gated out with the same timing precision as the original sampling.

Apart from the obvious advantage, elimination of wow and flutter confers another benefit by minimising "modulation noise" — that subtle muddying of tones when audio waveforms are subject to slight time jitter.

Print-through, too, ceases to be a problem — the tendency for the magnetic pattern to appear at low level on adjacent layers, when a tape is stored for a significant period of time. As indicated in these columns in the November issue, it prejudices the choice of tape for conventional analog master recordings, and the length of time and the conditions under which they can be stored.

Print-through does occur in digital tapes, of course, but not with the same dire results. Whereas a low-level print-through signal will be reproduced directly by an analog system, the print-through pattern on a digital tape is never likely to even approach the level of a true "bit" signal, equivalent to full particle magnetisation. The print-through signal is therefore totally ignored.

Last but not least, digital technology offers to the audio engineer certain unique facilities. For example, if the dynamics of a recording have to be modified for any reason, it is no longer necessary to rely on analog devices, such as for compression, Dolby processing, DBX processing, etc. A digital system can be programmed to modify the numbers, which define the audio waveform, in very specific ways. It becomes a highly predictable and routine exercise in "number crunching", computer style.

Another facility, inherited from professional video tape technology, is the ability to merge and edit by purely electronic means, without cutting tapes or even compromising the steady flow of timing pulses.

The one obvious technical hazard to the digital system is the possibility of "dropouts" in the mastering tapes — tiny areas where theere is a flaw in the magnetic coating. Such a flaw may effectively change a 1 to a 0 in a digial number, radically altering its value and what it says about the amplitude of the audio waveform at the relevant point.

However, the resources of the entire tape and computer industry have been ranged against the dropout problem and, apart from quality control of the tape itself, a variety of parity and redundancy techniques have been evolved to minimise the incidence of dropouts. This work is happily available to audio engineers.

Such then is the general theory behind digital recording. How does it stand up in practice?

Pictured on these pages are two

AT LONG LAST, IT'S HAPPENED!

To Stanton Magnetics Inc, making magnetic phono cartridges is a serious business, particularly when they turn out one like their state-of-the-art 881S.

It hurts them, therefore, when they see magnetic cartridge makers humiliated by dealers' "one cent" sales: the customer is offered a turntable for $150 as is, or fitted with a "magnificent" magnetic phono cartridge for $150.01.

But the HI FI FO FUM stores on Long Island N.Y went part of the way to make amends, recently, when they offered Stanton's 881S cartridge for its recommended retail price of $150, with a FREE Lenco L60B turntable!

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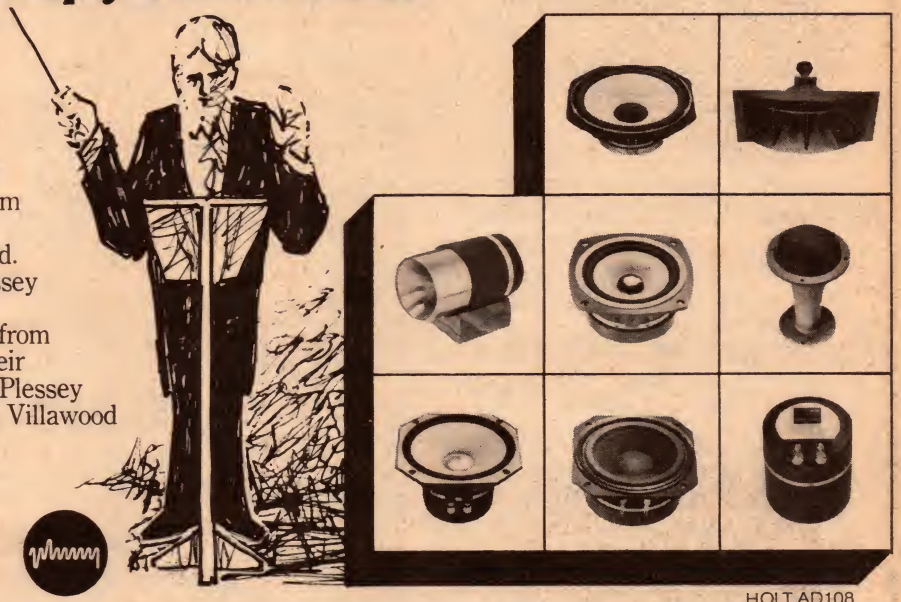

The Plessey Foster-Fostex range of hi fi speakers. If you've ever heard from them you'll know you've listened to the results of superb craftsmanship in the science of sound. Top performance can be yours through Plessey with the Foster-Fostex range of speakers.

Here they are, and we'd like to hear from you if you'd care to have the catalogue of their impressive technical features. Please write Plessey Australia, Components Division, PO Box 2, Villawood NSW 2163 or phone 720133.

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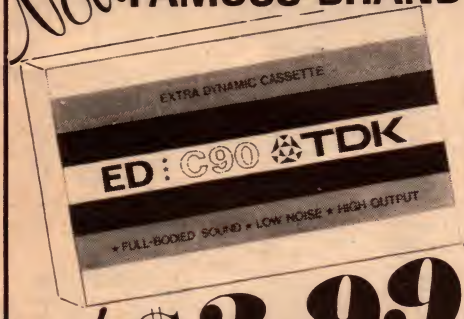

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typical albums, which have been produced from digitally recorded masters, and which are being marketed in Australia through PC Stereo, of Brisbane.

According to the jacket notes, the source signals from a group of special transformerless microphones were fed to a Studer 169 console and thence direct to a Soundstream multi-channel digital recorder. This operates at a sampling rate of 50,000 per second and uses a 16-bit encoding system, with provision for error detection as a precaution against dropouts.

Harold A. Rogers of "High Fidelity" magainze, who wrote the jacket notes, makes the points previously mentioned about low noise, dynamic range, freedom from wow and flutter, programmed in-computer editing, etc. He ends up with the observation that the stereo master and the copies which emerge from the digital processing are still true masters. Because, for all practical purposes, the digital processing has preserved the full response and added no noise, wow, flutter or distortion.

And this is certainly borne out by the figures on the Soundstream digital recording system:

Frequency response: Flat from 0 to 21kHz; —3dB at 22kHz. Total harmonic distortion: at 0 VU, less than 0.004%. Total harmonic distortion: At peak levels 0.03%. Signal to noise ratio: 90dB RMS unweighted. Dynamic range: 90dB RMS unweighted. Wow and flutter: Unmeasurable.

Andrew Powell, 19, capped his first year as an engineering student at Melbourne University by winning an interstate competition which provided most effective promotion for the BASF Ferro Super LH1 cassette. Andrew is shown accepting a Mini Moke — his first car — from Nigel Price, National Sales Manager/Magnetic Products, BASF Australia Ltd.

Digital master recorders like the Daystream don't come cheaply, being currently much more expensive that even top of the line analog equipment. But, if they can offer immunity to distortion and noise build-up, the major recording companies won't argue for too long.

As one overseas expert put it recently: It is no longer a question of what recording system will be dominant; it's simply a matter of how soon.

And, by the look of the figures, the sooner the better!

NATIONAL PANASONIC have released their TR5000A, a combination monochrome TV receiver, cassette recorder and AM/FM radio. Adding to its versatility is the fact that it can operate from an AC power point, from a 12V car or boat supply, of from its own internal batteries. The 13cm (diagonal) picture is bright enough to

view outdoors but a sunshield is provided for use where necessary. A three-way tuning/level meter is provided, plus separate bass and treble controls. All-up weight, without batteries is 4kg (9lb) and the construction is uch as to withstand "knockabout" use. The price: $330. For information: G. A. Dawes, National Panasonic (Australia) Pty Ltd, 5759 Anzac Parade, Kensington 2033.

STUDIO ELECTRONICS are distributors in Australia for a line of tape splicers manufactured by Nagy Research Products, Box 289 McLean VA 22101, USA. According to the brochure supplied, there are six models available, two for cassette tape, three for standard ¼-in tape and one for ½-in tape. All of them employ in-built self-sharpening shears which are claimed to cut the thinnest mylars cleanly and consistently, and without blunting of the cutting edge. For a brochure and price quotation: Studio Electronics, 3 Borwood Rd, Burwood, NSW 2134.

AMPEX AUSTRALIA PTY LTD has announced new appointments to its Sydney Head Office staff. Greg Martin is now Product Manager and David Williamson sales representative for professional tapes. Frank Kandelous has been appointed National Sales Manager, consumer tape products, and Barry Hume as NSW representative.

M.R. ACOUSTICS advise that they can now offer a stylus replacement service, by arrangement with the Garrott Brothers of Melbourne. A new conical stylus, fitted to the existing cantilever, costs $25, while a new elliptical can be fitted for $35. M.R. Acoustics are very keen, however, on the German Weinz parabolic stylus, which costs $45 to fit, or $55 for a moving coil cartridge.

Where a completely new cartridge is required, M.R. Acoustics — and the Garrott Brothers — recommend their own P-77 cartridge, fitted with a parabolic stylus and retailing for $89. For details: M.R. Acoustics, P.O. Box 110, Albion Qld 4010.

Up-dated recording studios for Madrigal

Although established for only three years at 89 Berry Street, North Sydney, Madrigal has just completed its second re-build to provide it with up-to-the-minute facilities for sound mixing and recording. The main studio is "floated" free of the building structure and can accommodate about 20 musicians, with isolation for vocalists and drums. A new control booth ensures optimum monitoring conditions with a "tight" stereo image. Maurie Wilmore, co-owner of the studios, is pictured with the 3M model 79 16-track recorder, with 24-track up-date capability. Studios and booth were designed by Eclipse Audio Design Pty Ltd, of 89 Chandos St, St. Leonards, NSW.

JVC SK-61 3-way loudspeaker

The JVC SK-61 is a bookshelf-sized three-way loudspeaker system housed in a sealed enclosure. It has a 25cm woofer and cone-type tweeter and midrange units. Power rating is quoted as 65 watts RMS.

In appearance, the bookshelf-sized JVC SK-61 is little different from other loudspeaker systems. Removing the grille does little to change that impression, although possibly the JVC is less flashy in the finish on the three drivers than some other brands.

Dimensions of the SK-61 are 545 x 300 x 231mm (W x H x D) and mass is 9.5kg. The enclosure is made of 12mm particle board finished in simulated walnut veneer. The removeable grille is covered with a charcoal coloured fabric.

At the rear of the enclosure is a recessed panel which has two knurled screw terminals for the cable from the amplifier.

The enclosure is partially filled with fibreglass batts in special synthetic fibre bags. Presumably the bags are to prevent allergy problems with the assembly workers and curious people such as audio reviewers!

The woofer is a nominal 25cm unit with a large ceramic magnet and a 40mm diameter voice coil. It has a fairly heavy curvilinear cone, generous roll surround and a pressed steel chassis. The effective cone diameter is about 18cm.

Both the midrange and tweeter and cone type units with ceramic magnets and sealed backs. The crossover network employs three iron-cored inductors and two non-polarised electrolytic capacitors to provide crossover frequencies of 2kHz and 8kHz. There is also a tweeter attenuator which can be adjusted when the front grille is removed.

Nominal impedance of the system is 8 ohms. Measurements indicate that the impedance peak is 27 ohms at about 77Hz which corresponds to the bass resonance. There is another impedance peak at 1kHz of 18 ohms, which probably corresponds to the resonance of the midrange driver.

Minimum impedance of the system was about 6.2 ohms (below 40Hz) so that the SK-61 is unlikely to present any loading problems with amplifiers designed for nominal 8 ohm loads.

During our initial listening tests we were most impressed with the overall balance of the SK-61. With the tweeter level control set at its midpoint the overall sound quality was surprisingly similar to our large reference loudspeakers. Further listening indicated that the frequency response was not quite as smooth in the midrange and the SK-61 lacked the more fundamental bass response of the bigger reference unit.

As with most sealed enclosures, the bass response is well maintained down to the system resonance and tapers gradually below it. There is a tendency for the woofer to distort (frequency double) with strong sine wave drive at frequencies of 50Hz and below.

Transient response of tne SK-61 is quite good and even though the panels of the enclosure are relatively thin, they do not seem to add significant colouration. Efficiency of the system is slightly lower than average for this class of loudspeaker, so that it needs a little more drive power.

JVC quote the power handling capability of the SK-61 as 65 watts RMS and we would take this to mean that the speakers could handle the output of amplifiers up this power rating on normal program material. We would add the proviso that for heavy rock and organ material, the bass should not be boosted otherwise distortion will become objectionable.

For similar reasons, we do not recommend that the cabinet be placed on the floor or close to the corners of the room. In any case, the enclosure is really too small to be placed on the foor — you would have to lie prone to hear the treble.

Our overall reaction to the JVC SK-61 is very favourable. It is a good-sized bookshelf loudspeaker system which most people will find easy to live with. Recommended retail price of the JVC SK-61 is $270 per pair.

Further information on JVC equipment may be obtained from high fidelity retailers or from the Australian distributors Hagemeyer (Australasia) B.V., 25 Paul Street, North Ryde NSW 2113. (L.D.S.)

An omnidirectional microphone for conferences, &c.

A new microphone, announced recently by the Astatic Corporation of Ohio USA, will be of special interest to anyone who needs to amplify or record proceedings in a conference situation where, for example, the participants are grouped around a table.

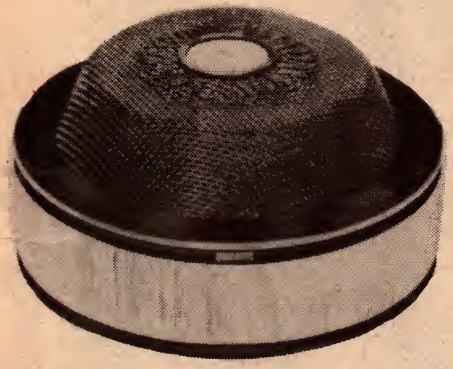
For such an occasion, conventional microphones can pose a number of problems. A prominent central microphone can prejudice discussion, deterring the timid and motivating the outspoken.

Small multiple microphones can have a similar effect, besides which they require multiple connection facilities.

Either way, the sound pickup patterns can be lumpy, and the set-up sensitive to noise transmitted via the table top.

The new Astatic "Model 1070 Spectrum" microphone has been designed with these things in mind. Described as a "vertically orientated cardioid dynamic" unit, it is intended to rest face-up on the table, being little more noticeable than a decorative ash tray. The diameter is 127mm and height 82.6mm, and the finish black with a black grille and woodgrain trim.

In this position it offers a 360-degree coverage, with a top response to at least 12kHz, a slight "presence" rise just



above 3kHz, and a bass response deliberately tapered below about 200Hz. Impedance is 250 (approx.) ohms and output a nominal —54dB.

It has in-built hum-bucking to counter stray fields and employs internal shock mounting to give it almost complete isolation from external vibration.

A single 1070 Spectrum microphone in the centre of a 5ft table is typically adequate for 6 participants. For a longer table, two units would be used in parallel. According to the distributors, one unit on the altar can usefully supplement a church P.A. system.

For further details: Nomis Electronics Pty Ltd, 689 South Road, Black Forest, S.A. 5035. Phone: (08) 293 4896.

Features bi-directional control without a reversing switch:

Bipolar model train controller

This simple train controller is ideal for both N gauge and 00/H0 gauge model railways. It is fully overload protected, and features smooth speed and direction control with a single knob. Estimated cost of all components, including the case is only about $25.

by DAVID EDWARDS

As you have probably guessed from the name we have given this project, it is based on the use of complementary transistors, in this case BD262 and BD263 power Darlingtons. The circuit is essentially a bipolar emitter follower.

As you can see from the circuit diagram, the only active devices used are the Darlingtons themselves. Overload protection and indication is provided by two light emitting diodes (LEDs). The unit can supply positive and negative voltages variable from 0V to about 20V, with the output current limited to a maximum of 1A.

The output voltage is determined by the setting of the 1k potentiometer, which forms the loco speed and direction control. When the control is centred, there is no output voltage, and the loco remains stationary. When it is rotated clockwise, the output voltage increases, driving the train in one direction, while anti-clockwise rotation produces movement in the opposite direction.

The neat appearance of the prototype can be seen in this photograph. One or other of the LEDs will light in an overload condition.

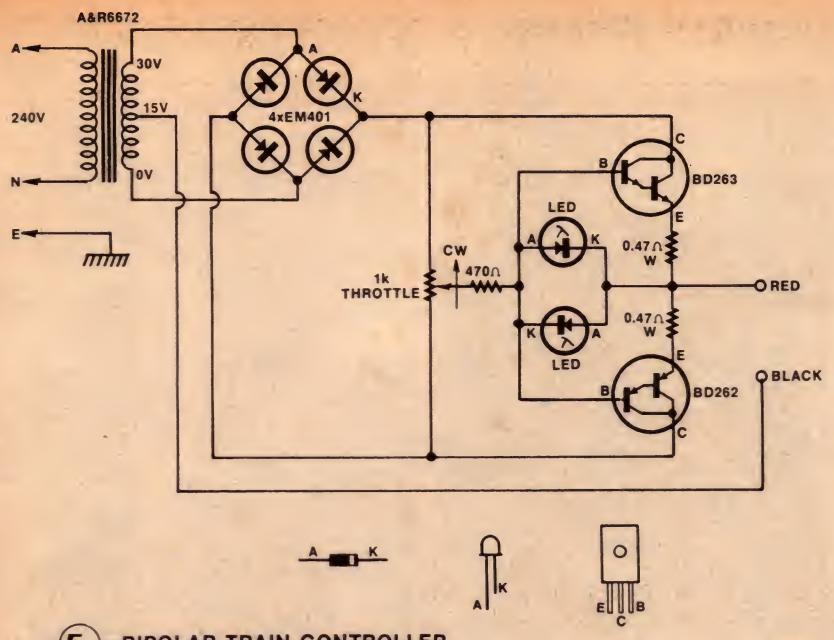
Operation of the circuit is as follows: the voltage at the wiper of the potentiometer is passed to the bases of the transistors by the 470 ohm resistor. This will forward bias one Darlington transistor, and cut off the other one.

The forward biased Darlington transistor operates as an emitter follower, and supplies current to the load (in this case the loco) via the 0.47 ohm emitter resistor. The emitter follower action applies local negative feedback, and tends to keep the voltage applied to the train constant, irrespective of the load current. So the loco tends to have improved "pulling power", even at low speeds.

In normal operation, the combined base-emitter drop of the conducting Darlington (1.2V), and the voltage produced across the 0.47 ohm resistor is less than 1.7V, and so the LED does not emit. (The LEDs are connected in inverse parallel, so that one or the other will tend to be forward biased whatever the output polarity.)

In an overload situation, however, the voltage drop produced in the 0.47 ohm resistor will increase as the load current increases. When the output current reaches 1A, the combined voltage across the LEDs will rise to 1.7V, and the forward biased LED will start to conduct.

As the LED starts to conduct, it will emit, giving a visible indication of the



EA BIPOLAR TRAIN CONTROLLER 2/MC/-

ABOVE: As you can see from the diagram, the circuit of the controller is very simple.

PARTS LIST

1 Horwood case, 34/6/DS, 152 x 101 x 76mm
1 1k linear potentiometer
1 knob
2 red light emitting diodes, with mounting hardware
1 BD262 PNP power Darlington transistor, with mounting hardware
1 BD263 NPN power Darlington transistor, with mounting hardware
4 EM401 silicon diodes
2 0.47 ohm 5W resistors
1 470 ohm ½W resistor
2 terminals, 1 red, 1 black
1 mains transformer, 30VCT @ 1A
4 rubber feet
1 mains flex, plug, grommet, cord clamp and terminal block
3 6-way tagstrips
Solder, hookup wire, solder lugs, insulated sleeving, machine screws and nuts.

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.

overload condition. But more importantly, it will bleed some of the base current away from the Darlington, and hence it will limit the output current. The purpose of the 470 ohm resistor is to limit the current to the LEDs and the transistors to a safe value, particularly at either extreme of the potentiometer.

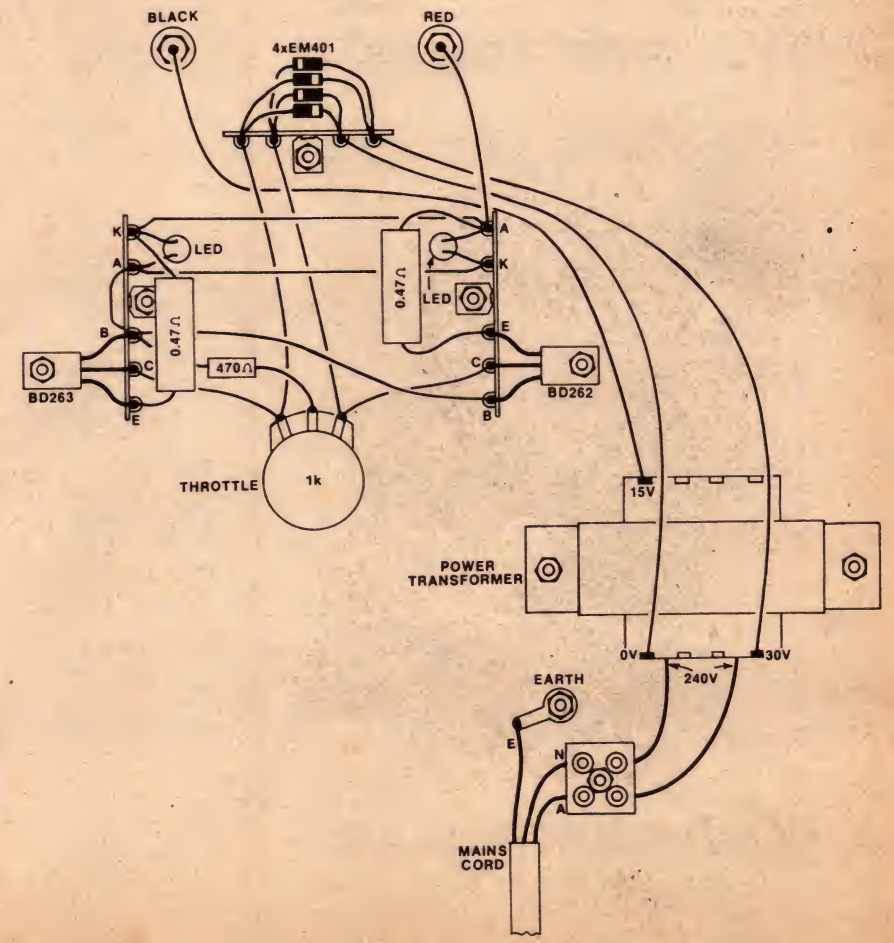
The required positive and negative power supplies are derived from a 30V centre tapped transformer with a 1A rating, via a bridge rectifier. No filter capacitors are required, as ripple on the output is actually beneficial to the operation of the train — the AC components help to overcome "stiction".

We constructed the prototype in an extruded aluminium case, measuring 152 x 101 x 76mm. This was a Horwood case, code number 34/6/DS, and is available from a number of suppliers. The prototype case came from Radio Despatch Service, of 869 George Street, Sydney, NSW 2000. The extruded aluminium tube, which forms the major part of the box, is fitted with two removable end plates, and is also split in two lengthwise.

This latter feature is most important, as it greatly facilitates assembly of the components into the case. The transformer we used was an A & R type 6672; an equivalent transformer is also available from Dick Smith stores. All other components should be readily available from your local electronic store. The LEDs can be any red type, and are not critical. The types supplied with the plastic mounting clips are the most suitable from a constructional point of view, as well as being cheaper.

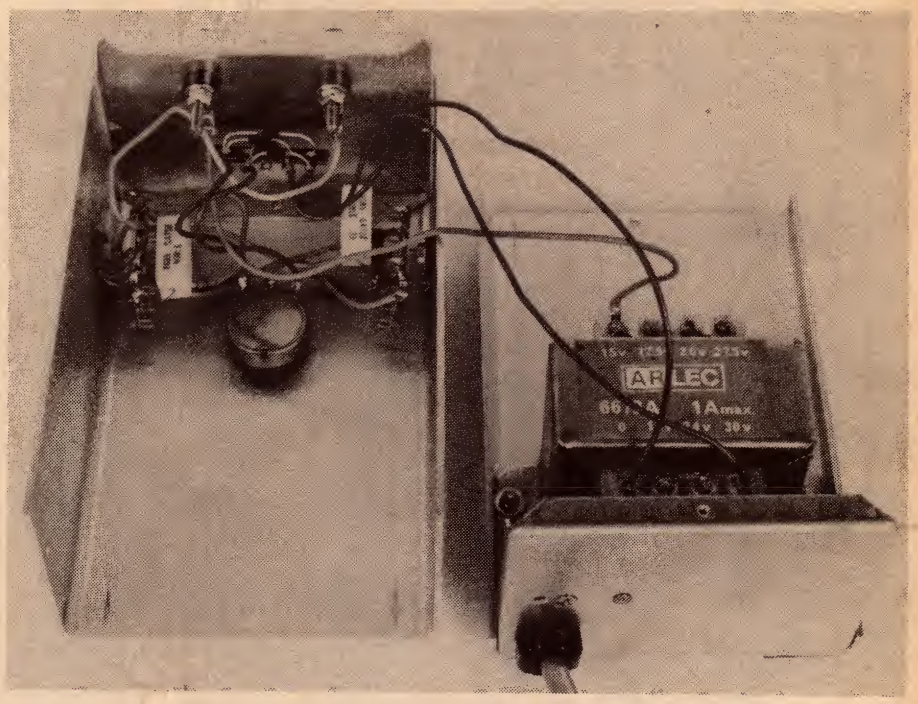
The 0.47 ohm resistors should be 5W ceramic-cement types. The 470 ohm resistor can be a standard ½W part.

BELOW: Even inexperienced constructors should be able to build the controller, by following this wiring diagram explicitly.



Bipolar train controller

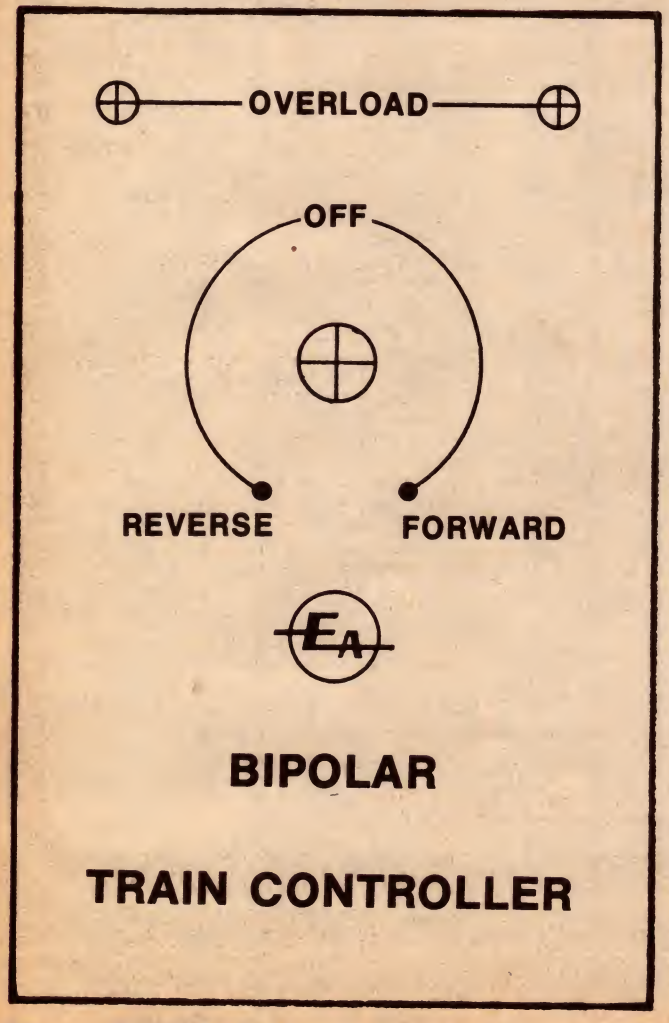
RIGHT: In this photograph, you can see how the case splits into two sections, with only three wires between them.



Make sure that you obtain insulated mounting kits with the transistors, as these must be insulated from the case. Three lengths of 6-way tagstip are also required, to form a mechanical support for the wiring and small components.

We made a front panel for the prototype from photosensitive aluminium. The artwork we used is reproduced full size with this article, and may be used directly, or copied. Use it as a guide to mark the positions of the three holes required in the front panel.

Construction of the unit should not prove difficult. Use the exploded wiring diagram as a guide, and complete all the mechanical assembly first. The mains cord must be securely grommetted and clamped at the entry point to the case, and the earth lead connected directly to a solder lug bolted securely to the case chassis.



LEFT: This actual sized reproduction of the front panel can be used directly if required. Commercial panels should be available in due course.

The active and neutral leads are terminated in a two-way terminal block, and then are routed directly to the primary of the transformer. The rectifying diodes are mounted on a small tagstip positioned between the two output terminals. The remaining two tagstips are used as shown to mount the LEDs, power transistors and emitter resistors. The 470 ohm resistor is wired directly between the pot wiper and the base of one transistor. You will need to insulate the leads with plastic sleeving.

Care will be required to mount the appropriate transistor in the correct location (the BD263 goes on the left, as in the diagram), and to wire the LEDs into circuit correctly. Follow the diagram explicitly.

Once you have completed the unit, double check all wiring, and then switch on. Use a voltmeter to check that the output voltage can be controlled by the knob, and that both positive and negative output voltages can be obtained.

If all is OK, connect up to a train, and give the unit a practical test. The LEDs should illuminate (only one at a time) when an overload is applied. If you have a suitable ammeter, connect it directly across the output, and check that the maximum output current is about 1A, in both directions.

If you wish to increase the output current capability, insert a 1N914 silicon diode in series with each LED and use diodes with a higher current rating for the bridge rectifier. 1N5408 types are suitable.

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DICK SMITH ELECTRONICS

12-230V inverter with overload protection

This article describes the operation and construction of a 300VA inverter capable of supplying 230 volts at 50Hz from a 12 volt DC source. The output is voltage regulated, and has current limiting with ultimate thermal shutdown.

by I. M. WOODHEAD*

It is often necessary to operate 230V AC equipment in an area where the mains supply is unavailable. This may include, for example, electric hand tools, measurements in the field with laboratory equipment, or perhaps domestic appliances.

There are two alternatives: either an engine-driven alternator, or an inverter operating from a storage battery. If a large power output is required, or if it is necessary to operate the supply for an extended period of time, an engine-driven alternator is the obvious choice.

*New Zealand Agricultural Engineering Institute, Lincoln College, Canterbury, New Zealand.

But if energy requirements are relatively low, an inverter has the advantages of quietness, efficiency, and the possibility of exact frequency control.

A transistor inverter can be either self-oscillating or driven. However, the low-cost and relative compactness of a self-excited inverter are outweighed by two disadvantages: frequency and output voltage are notoriously variable with changes in supply voltage and load. In addition, the transformer used in a self-excited inverter has to meet tight specifications on leakage inductance, mutual inductance, and winding resistance if the operating frequency is to stay within the design limits.

In a driven inverter on the other hand, these problems are eliminated. The output voltage can be controlled by pulse width modulation and if it is necessary to control the frequency precisely (to drive chart recorders, turntables, or tape recorders for example), then this can be done using a crystal oscillator. It is the drive circuitry which determines the characteristics of the driven inverter; the transformer is merely used for voltage conversion so its specifications are not critical.

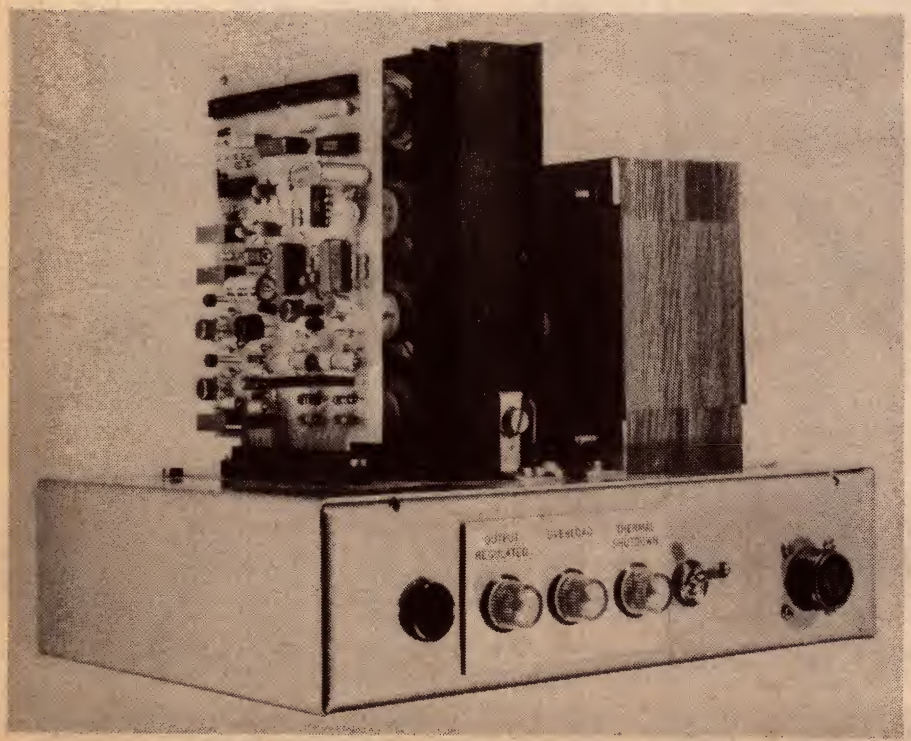
For all these reasons, a driven inverter is considered the most versatile and so forms the basis of the design described here.

Referring now to the circuit diagram, a conventional crystal oscillator using a CMOS NAND gate drives four series-connected CD4017 decade dividers. The crystal frequency is 1MHz so the resultant frequency is 100Hz. This is then fed to a CD4018 presettable counter wired in the divide-by-two mode to give two antiphase outputs.

These outputs are fed via NAND gates to drivers consisting of two series-connected Darlington pairs, and thence to the primary windings of the transformer. The NAND gates are capacitively coupled to the drivers to prevent one driver conducting should the oscillator fail.

Two output transistors are used for each phase. These ensure adequate gain, the typical gain of a 2N3771 being 20 at 15A, and 10 at 30A. The use of a transistor pair also reduces the saturation voltage since the current in each transistor is halved. In the prototype, with a 250W load, the saturation voltage when using one transistor was 2.0V. When the second was connected, the saturation voltage dropped to 1.1V.

The ideal way of ensuring that two paralleled transistors take on equal current is to use emitter resistors chosen so that the voltage across each resistor is of the order of 0.5V. This applies negative current feedback



Above is the prototype. A PC board accommodates most of the components, and is mounted on top of the chassis with the heatsink and power transformer.

which reduces gain and saturation voltage variations between the two transistors. However, this is rather wasteful of energy when large currents are involved. To avoid this, base resistors R14 and R15 along with R16 and R17 were used to equalise transistor collector currents. Current sharing using this method has proved to be quite satisfactory.

Diodes D1 and D2 conduct the reactive current after their opposite transistor pairs have ceased conduction. The current pulse they have to pass is of the order of 30A when the power factor is 0.2. However the conduction period is short and diode specifications indicate that a 2.5A rating is sufficient.

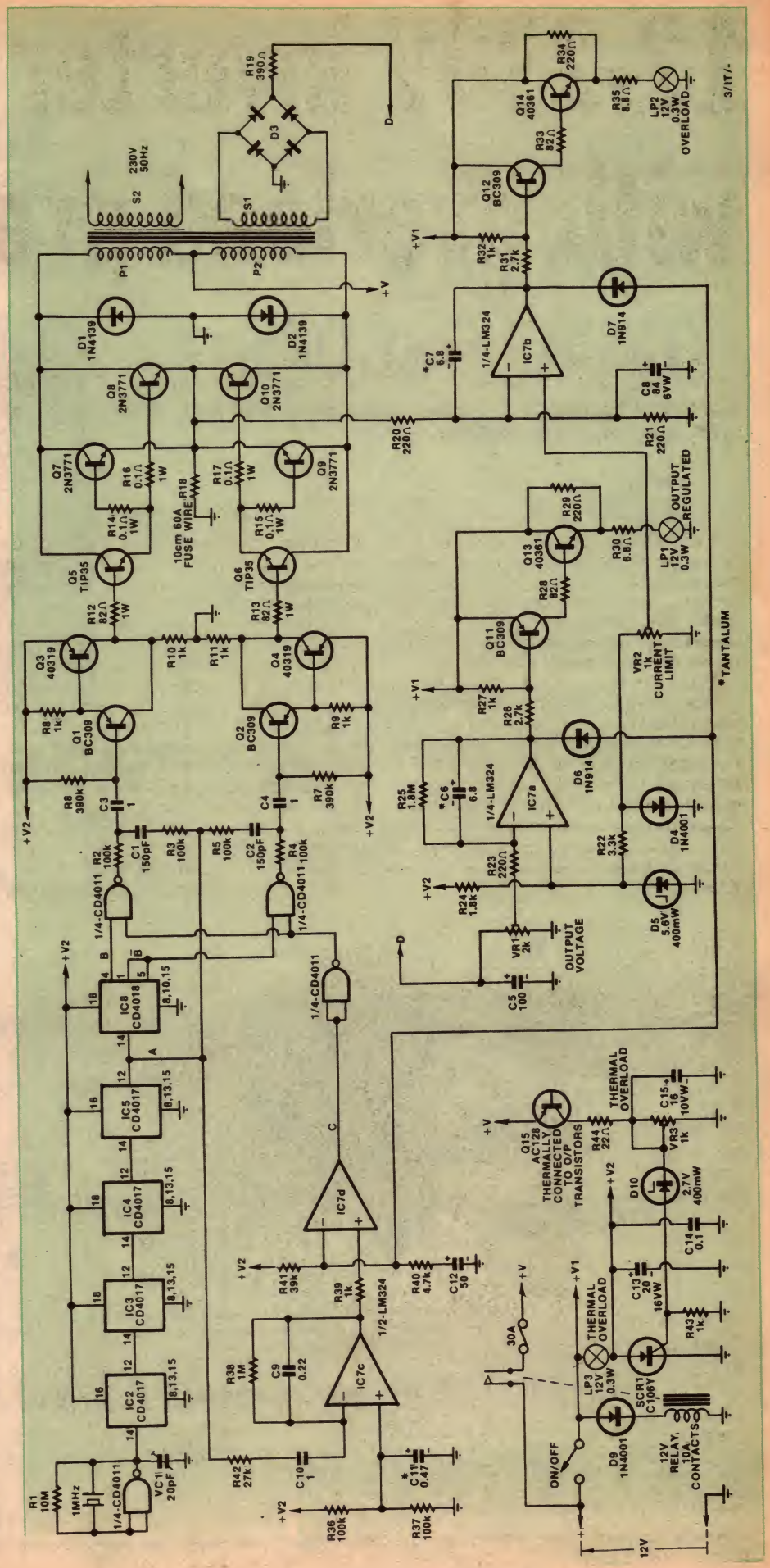
The 100Hz square wave is picked off the input of the CD4018 and differentiated by C1 and C2 with R3 and R5 before being fed to the inputs of each phase driver. This slows the switching times of the drivers and therefore reduces the maximum possible pulse width of each phase to slightly less than 180°, ensuring that under conditions of maximum power transfer, the current in one transistor pair has decayed to zero before the other pair begin to conduct. It also slows the switching time from 10us to 60us. At full power this results in a switching loss at only 0.6W which is negligible.

The power output of the inverter is determined by the pulse width of the signal fed to the driver stages. This is controlled by error voltages derived from both the output voltage and current. A sample of the output voltage is obtained from secondary winding S1. This voltage is rectified by the full wave bridge D3, filtered, and applied to the inverting input of operational amplifier IC7(a) via the output voltage control potentiometer VR1. The resulting DC voltage is compared in the amplifier with a 5.6V reference from D5 to yield a voltage error signal.

To obtain a current error signal, the supply current to the output transistors is passed through R18 to develop a voltage proportional to current. This is averaged and compared with a reference derived from diode D4, which is pre-regulated by D5.

Operational amplifier IC7(b), which amplifies the current error signal, has a large feedback capacitor to ensure stability when the inverter is in the current limited mode. The amplifier has, in this configuration, a large DC gain equal to the open loop gain of the amplifier — about 100dB — and an AC gain of almost unity.

The outputs of IC7(a) and IC7(b) are fed via a diode OR gate to the inverting



At right is the complete circuit diagram of the 12-230V inverter. Main features of the circuit include crystal-controlled output frequency, voltage regulation, and overload protection.

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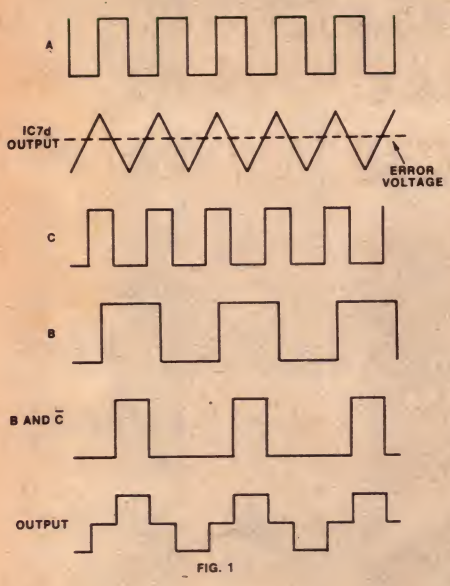
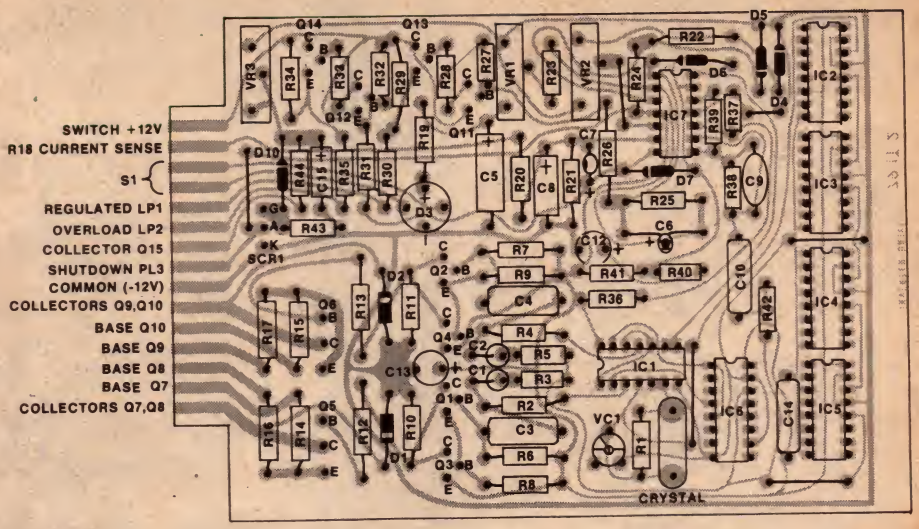


FIG. 1



This component overlay diagram shows the PC board as viewed from the component side. Make sure that polarised components are correctly oriented.

input of IC7(d). A delay circuit, consisting of R41, R40, and C12, controls the rate of change of voltage on this input. This is necessary because the long time constant of the voltage sensing circuit would otherwise cause the output voltage to overshoot when the unit was switched on. R40 is included to allow a small rapid change to be made to the output voltage. IC7(d) is wired as a comparator.

The DC error signal applied to the inverting input is compared with a 100Hz triangular wave fed to the non-inverting input. The triangular wave is generated by IC7(c), which integrates the 100Hz square wave obtained from the 4018 input.

The result of the comparison in IC7(d) is a pulse-width modulated 100Hz square wave. This signal is fed via an inverter to the NAND gates of each phase of the 50Hz drive, the phasing being such that the off-time of each phase is proportional to the error signal. Reference to Fig. 1 will clarify the formation of the various waveforms.

A National LM324 (or RCA CA324) quad op-amp is specified for IC7. This was chosen because, for the current error amplifier, the inputs are almost at zero volts. The 324 can be kept in the linear mode, even when the inputs are at ground potential.

The outputs of the error amplifiers are fed to discrete lamp drivers to indicate the running mode. Lamps were chosen because LEDs are difficult to see outdoors or under strong lights. The lamp driver transistors Q13 and Q14 each have a parallel resistor to keep a small current flowing through the lamp. This keeps the filament just less than red and its resistance somewhat greater than its value when cold. In addition, series resistors, R30 and R35, are used to ease the load on the 40361 drivers, thus enhancing their reliability.

As can be seen from the overlay diagram, the PC board has been designed to plug into a socket. If the socket is not going to be used, holes should be drilled through the contacts in order to properly secure the connecting wires before soldering.

Although the layout is not critical, the wires connecting the output transistors, transformer primary, fuse, relay contacts and battery leads should be capable of handling 30A. Attention should be paid to solder joints and to cleaning the enamel insulation from the transformer primary wires. Poor joints can cause considerable voltage drops at 30A. The supply fuse should have a rating of 30A-35A.

The current sensing resistor consists of about 100mm of 60A fuse wire

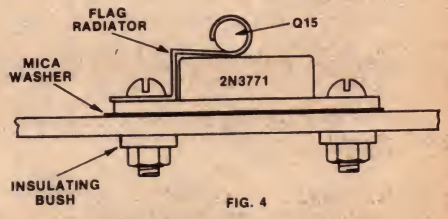


FIG. 4

mounted on either a component board or between two tag-strips. This wire has a diameter of 1.3mm but any copper wire with a diameter between 1mm and 2mm would be satisfactory.

Thermal overload sensing and protection is provided by Q15 and SCR1.

Since the prototype is to be used in arduous conditions, quality Canon sockets were used for the input and output. For general use however, flying leads for the battery supply and a conventional mains socket for the output

Performance of prototype . . .

Nominal supply voltage	**12.6V**
Output voltage	**230V**
Frequency	**50Hz ±0.01%**
Regulation	**5%**
Maximum load	**300VA**
Current limiting	**30A (primary)**
Efficiency (full resistive load)	**85%**

are suitable.

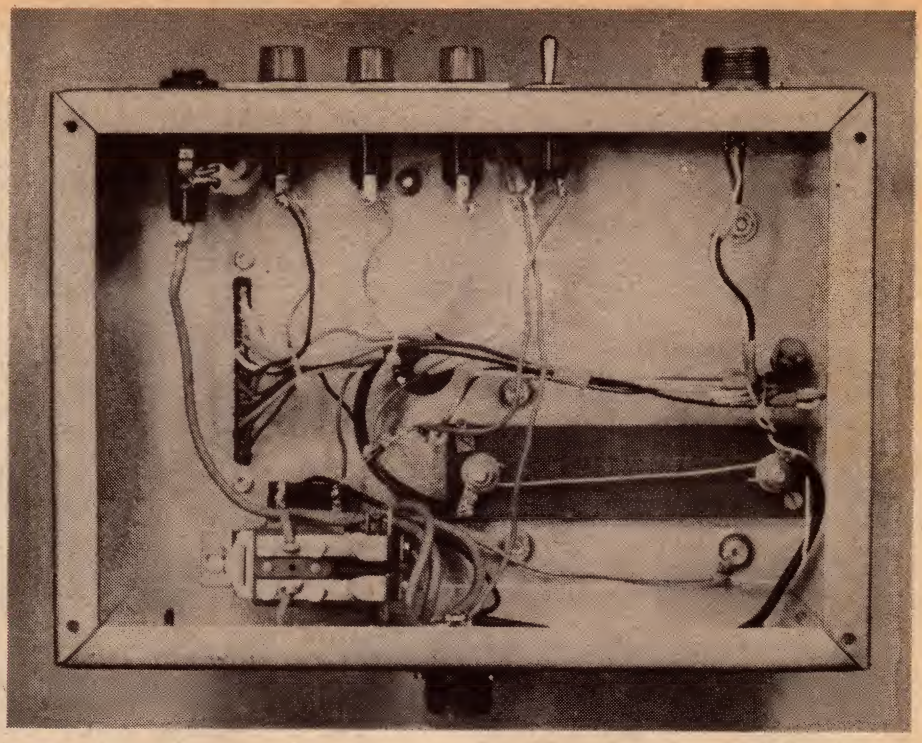
The output transistors are mounted on 20cm of extruded aluminium heatsink. Although the heatsinking requirements are quite small in the normal operating mode, all the power is dissipated in the output transistors when the output is shorted, so an appropriate heatsink is required. Q15 is thermally connected to one of the output transistors with a flag type heatsink. Mounting details are shown in Fig. 4.

The transformer may have a specification similar to a mains transformer and can be specified by the VA rating and the turns ratio. Suggested windings are:

Primary	10.5 — 0 — 10.5V
Secondaries	12V, 0.1A
	230V, 1.5A
Rating	300VA

The reverse polarity protection relay must have contacts which are capable of passing, but not necessarily switching, 30A. A relay with a 12V coil and having a contact rating of 10A will suffice. Ten-turn trimming potentiometers are used as they allow easier setting of the voltage and current limits.

The setting up procedure should be adhered to because, until it is set up, the inverter has no protection and failure of the output transistors could result. Before connecting the power, set the voltage and current potentiometers fully anticlockwise and the thermal overload fully clockwise. Apply the power and, if the unit has been correctly wired, it will operate with either the regulated lamp or the overload lamp illuminated.



An "under-the-chassis" view. R18 (10cm 60A fuse wire) is located on the tagboard at right, while below left is the relay. Leads to heatsink transistors and transformer pass through grommetted holes.

To set the output voltage, either a true RMS voltmeter will be required, or the adjustment will have to be carried out using an approximate comparison method. If an RMS meter is available, lightly load the inverter (using a 100W lamp for example) and advance the voltage control potentiometer until the meter, connected to the output, reads 230V.

To adjust the output using the comparison method, put a 100W lamp on the inverter output beside another 100W lamp connected to the mains. Advance the voltage control until the light output of each lamp appears the same. If during this procedure the overload lamp is illuminated, advance the current control one turn.

Note that because the waveshape of the output is non-sinusoidal, a normal voltmeter will give an erroneous reading.

PARTS LIST FOR 12-230V DC-AC INVERTER

SEMICONDUCTORS
1 CD4011 quad 2-input NAND gate
4 CD4017 decade dividers
1 CD4018 presettable counter
1 LM324 quad op-amp
4 BC309 or BC212 PNP transistors
2 40319 or BC640 PNP transistors
2 TIP35 NPN transistors
4 2N3771 NPN transistors
2 40361 or BC337 NPN transistors
1 AC128 PNP transistor
2 IN4139 silicon diodes
2 IN4001 silicon diodes
2 IN914 silicon diodes
1 2.7V 400mW zener diode
1 5.6V 400mW zener diode
1 B60 C800 bridge rectifier
1 C106Y SCR

RESISTORS (½W unless stated)
4 x 0.1 ohms 1W, 2 x 6.8 ohms, 1 x 22 ohms, 2 x 82 ohms, 2 x 82 ohms 1W, 5 x 220 ohms, 1 x 390 ohms, 8 x 1k, 1 x 1.8k, 2 x 2.7k, 1 x 3.3k, 1 x 4.7k, 1 x 27k, 1 x 39k, 6 x 100k, 2 x 390k, 1 x 1M, 1 x 1.8M, 1 x 10M, 2 x 1k trimpots (Bourns Model 3069), 1 x 2k trimpot (Bourns)

CAPACITORS
2 150pF ceramic or polystyrene
1 0.1uF polyester
1 0.22uF polyester
1 0.47uF 16V tantalum
3 1uF 16V tantalum
2 6.8uF 16V tantalum
1 16uF 10V electrolytic
1 20uF 16V tantalum
1 50uF 16V tantalum
1 64uF 6V electrolytic
1 100uF 16V electrolytic
1 20pF trimmer (optional)

MISCELLANEOUS
1 Transformer (see text)
1 PC board, 100 x 147mm, Code 79it2
3 12V 0.3W lamps and holders
1 1MHz crystal
1 15-way Amphenol PC socket, 0.156in connector spacing
1 12V SPST relay, 10A contacts
1 SPST toggle switch
1 240V ouput socket
20cm extruded aluminium heatsink
1 Flag-type heatsink
1 30A fuse and fuseholder
1 chassis with vented cover
4 rubber feet

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for the prototype. Components with higher ratings may generally be used, provided they are physically compatible.

After the output voltage has been set, put a 300W load on the inverter (three 100W lamps) and adjust the current control potentiometer until the inverter is just at the point of going into the overload state. Alternatively, if a true RMS ammeter is available, set the current limit to 30A.

The next step is to check and adjust the thermal overload protection. To ensure that it is operative, turn the overload control fully anticlockwise and then put a large load, for example a 1kW heater, on the output and switch on. The protection circuit should shut down the inverter within about 30 seconds, lighting all the lamps. However as a precaution, keep a finger on one of the output transistors. If the thermal overload circuit hasn't shut the unit down by the time the transistor is too hot to touch, switch off and recheck wiring.

Assuming that everything functions correctly, all that remains is to set the shutdown temperature. Allow the unit to cool and set the control fully clockwise. Switch on again and, when the transistors are almost too hot to touch, remove the load and turn the control back until the unit goes into the overload mode. Alternatively if a contact thermometer is available, set the temperature limit when the transistor case reaches 65-70°C.

The design of this inverter incorporates some features which may not be required and could therefore be omitted to reduce the cost.

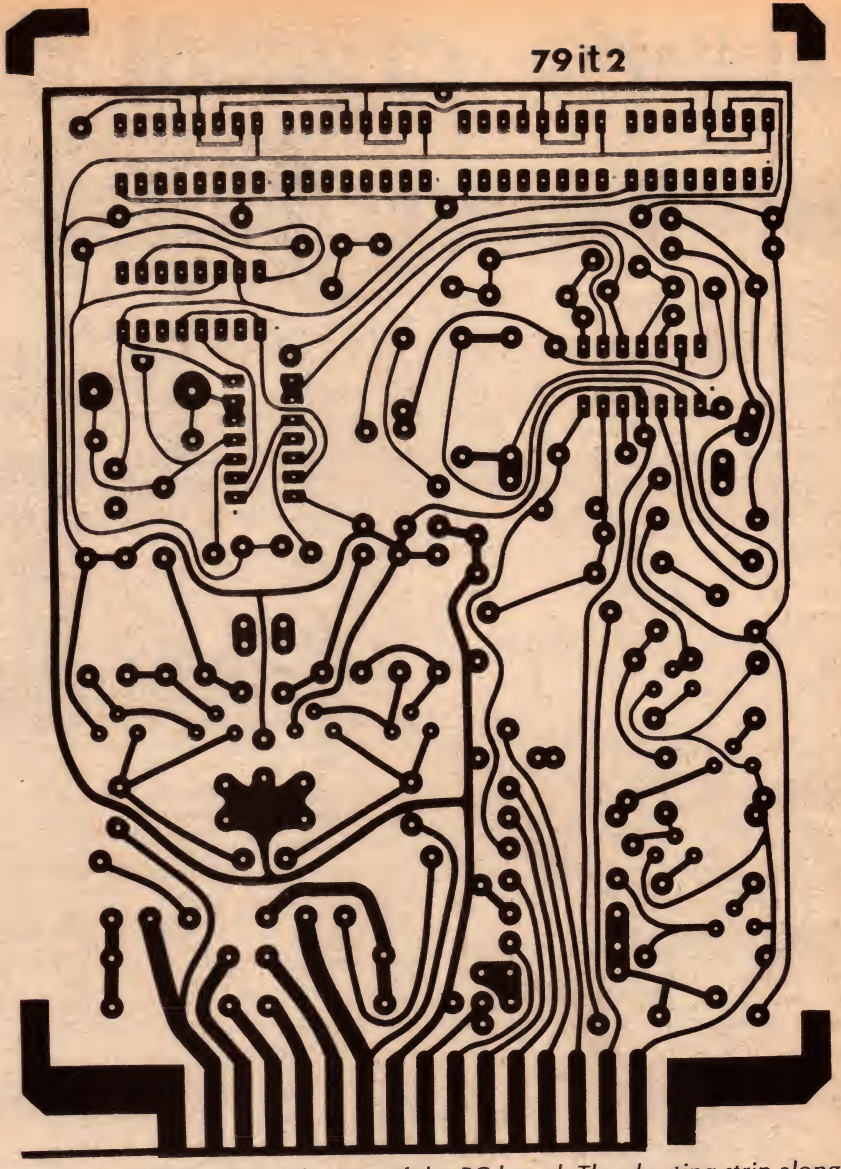
Crystal frequency control is only required when the load is particularly frequency sensitive. If this is not the case, the 4011 may be replaced with a 4093 quad two-input NAND Schmitt trigger. Then by replacing VC1 with a fixed capacitor and removing the crystal, a free running oscillator is formed (see Fig. 2). All the 4017 dividers are thereby eliminated and a wire link is taken from pin 4 of the 4093 to pin 14 of the 4018.

With this oscillator, the frequency depends somewhat on supply voltage but will suffice for most applications; it will still remain independent of load.

The reverse polarity protection relay may be eliminated. Reverse supply polarity will then blow the fuse. However diodes D1 and D2 may be destroyed by the heavy current surge so they should be replaced with diodes rated at more than 10A. Also, a diode should be wired across C14 with its anode to the negative rail so that the control circuits won't "see" the reverse voltage.

The lamp drivers can also be eliminated if desired. R26 and R31 should then both be changed to 1k and the rest of each driver circuit replaced by a LED, the anode of which is connected to the positive supply (see Fig. 3).

The prototype has an idling current of 1.2A with an efficiency of 85% at 250W. The inverter can handle power factors from zero to unity, lagging or leading. The output voltage is within 5% of 230V except for zero load and power factors deviating too far from unity. This is due to the voltage sensing circuit which reads the average output voltage rather than the RMS value.



Here is an actual size reproduction of the PC board. The shorting strip along the bottom is to allow the edge connectors to be gold plated.

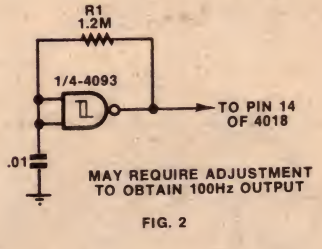


FIG. 2

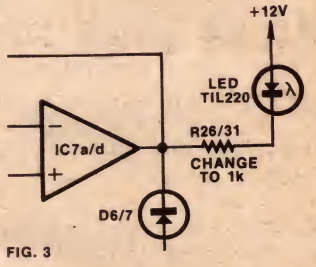


FIG. 3

Notes on components . . .

The transformer specified for this project is not a normal stock item. We understand that if there is sufficient interest, the transformer will be manufactured by Transcap Pty Ltd (Brookvale, Sydney) and distributed through Watkin Wynne Pty Ltd, 32 Falcon St, Crows Nest, NSW 2065. Alternatively, readers may be able to take advantage of the specifications given in the text by modifying an existing mains transformer. 2N3771 NPN power transistors are available from Radio Despatch Service, 869 George St, Sydney, NSW 2000.

Quartz crystal driver for Yaesu Musen clock

Following on from our article in October last, describing how a Yaesu Musen clock could be synchronised with the 50Hz mains frequency, here is how the same clock may be synchronised from a low cost American colour TV crystal. The short term accuracy should be better than before but with some overall drift over a long period.

by IAN POGSON

In October 1978, I described how a Yaesu Musen Model QTR-24 clock could be synchronised to the 50Hz mains. At that time I suggested that it should be possible to synchronise the same clock by using a quite cheap American colour TV crystal, in association with a CMOS IC (type MM5369) which divides to 60Hz. This idea worked extremely well in practical terms, and the reader should have no difficulty in duplicating our prototype.

The crystal frequency is 3579.545kHz and the MM5369 IC includes a crystal oscillator section. The crystal oscillator output is available via a buffer, so that measurements may be taken. The IC also divides it by 59659, which gives a nominal output of 60Hz.

We say "nominal" because if we divide 3,579,545Hz by 59659, we get 60.000084Hz. If we used this odd frequency we would expect the clock to gain a little over one second in 10 days. Fortunately, by simply trimming the crystal frequency a little lower, to 3,579,540Hz, we get precisely 60Hz.

At this point we needed to consider whether this 60Hz could be used to drive the clock directly, or whether it would need dividing to 30Hz. In the earlier project we changed the 50Hz mains frequency to 30Hz so that it would be a multiple of the six beats of the clock to be driven. Happily, the 60Hz available from the 5369 is also divisible by six. However, we had to establish whether the pulses of the clock movement to be driven were wider than the positive going pulse of the 60Hz component. A check showed that all was well and that we could synchronise directly from the 60Hz.

So much for the figures. Let us look at the circuit and see how it is done. The crystal is connected between pins 5 and 6 of the 5369. It is shunted by a network of capacitors to trim the crystal to the exact frequency. There is a 33pF capacitor in series with a 7-36pF trimmer, the latter as a coarse frequency adjustment, and a 3.5-13pF trimmer in series with fixed 3.3pF as a fine frequency adjustment. These latter are shunted across the larger trimmer.

The crystal is an AT cut. This has a very good temperature coefficient which is usually (but not always) negative, ie, decreases in frequency with increasing temperature. We sought to introduce further temperature compensation in the form an N750 type for the 33pF series capacitor. With the particular crystal shown on the board, the compensation is a little more than required. This will vary from crystal to crystal, and the compromise should be a fairly good one.

The 60Hz emerges from pin 1 of the 5369. Before it can be used to synchronise the clock movement, it must be processed. The output level is reduced by the 4.7k and 560 ohm resistors forming a voltage divider. The reduced signal is fed to an emitter follower Darlington pair, via a 1uF blocking capacitor. The required DC level across the 220 ohm output resistor is set with the 220k trimpot, giving a DC component on which is superimposed the correct level of 60Hz component.

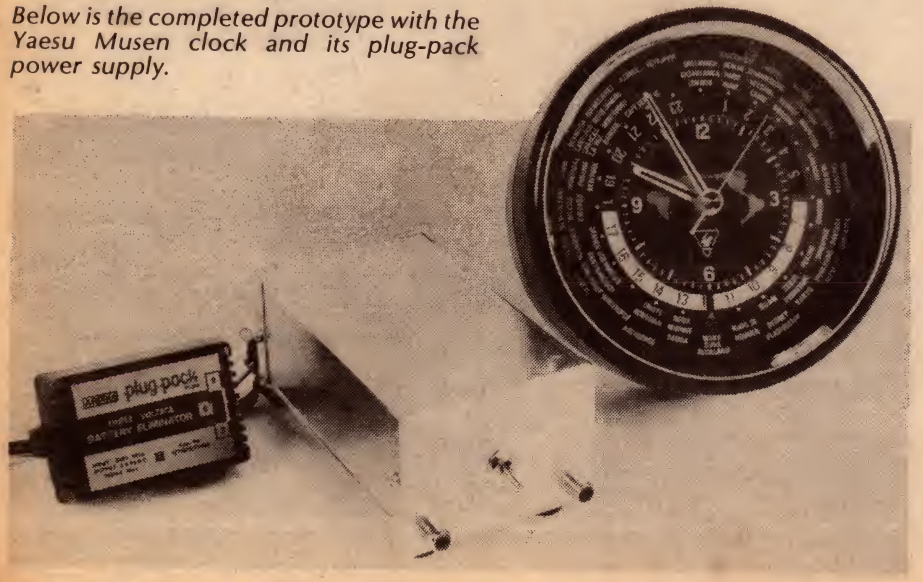
The switch between the emitter follower output and the clock movement is used for setting the time and more will be said about this under setting up and adjustments.

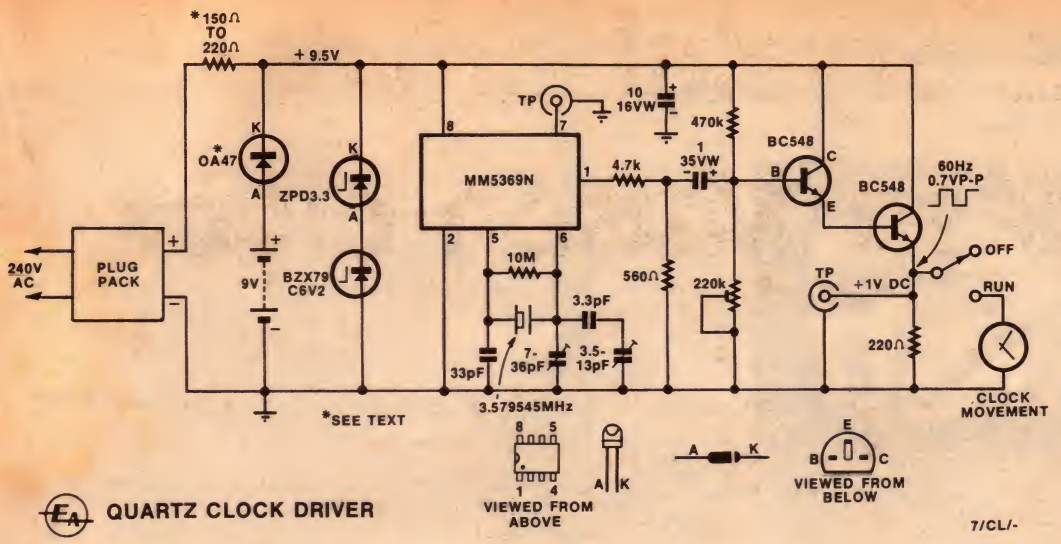
For a convenient power supply, I used a "plug pack". These are available in a number of brands and they consist basically of a small transformer, with rectifier and filter, built onto two pins of the standard three-pin plug. The device is double insulated.

The circuit needs about 9V DC, and this voltage should be as stable as possible, since voltage changes can change the oscillator frequency. The voltage regulation from the plug packs is quite poor and the nominal 9V output can be as high as 12V when unloaded or lightly loaded. The logical approach is to regulate this higher voltage down to 9V or so with a zener diode.

As zener diodes vary their voltage

Below is the completed prototype with the Yaesu Musen clock and its plug-pack power supply.





At left is the complete diagram of the crystal drive unit. The crystal is a low-cost type as used in American colour TV sets.

output with changes in temperature, we have taken steps to combat this as well. Without going into a lot of details, suffice it to say that different nominal zener voltages have different temperature coefficients. By combining two diodes with opposing temperature coefficients, we can more or less cancel the temperature effect. Combining a 6.2V zener diode with one at 3.3V gives us a nominal 9.5V regulated, with very little variation due to temperature change.

The usual dropping resistor is required between the unregulated source and the zener diodes. The value will vary according to the brand of plug pack. With the Arlec brand, the unregulated voltage was 11.2 and, on the basis of 12mA drain, the resistor works out to be 150 ohms. We also tried a Ferguson pack and the unregulated voltage from this was 12.2, which requires 220 ohms. If you use a pack which delivers a voltage other than those quoted, then the series resistor should be changed accordingly.

It may be asked why the dropping resistor needs to be changed at all, provided that the zener diode dissipation is not exceeded. The answer is that, due to the rather broad knee on the zener diode curve, the output voltage rises significantly if the input voltage is increased by the amount which we have just quoted. This may not matter in itself but we have also provided for a battery backup in the event of a mains failure. In the worst case, the difference between the normal supply voltage and that from the battery would be too great, leading to a significant change in oscillator frequency.

The standby battery is isolated from the main supply by a diode. Of the diodes available, the OA47 gold bonded type appears to offer the least voltage drop (about 0.3V) at the current drain involved. However, this could be too low in some circumstances. It is possible for a new battery to be as high as 9.6V, while the zener network could be as low as 9V. If so, it would be better to use either an OA91 or a silicon EM401, or similar.

It must be realised that operation from the battery involves some drop in voltage and, therefore, some change in frequency. On a short term basis, such as is usually involved with power failures, the error will be minimal and, in any case, is far preferable to a complete clock failure.

Some comments on components may be helpful. The two-piece sheet aluminium box used for the prototype accommodates all the components without overcrowding. However, if you wish to use another box there is no reason not to do so. At the same time, I would recommend an all-metal box, in that it shields the crystal against the proximity effects of other objects.

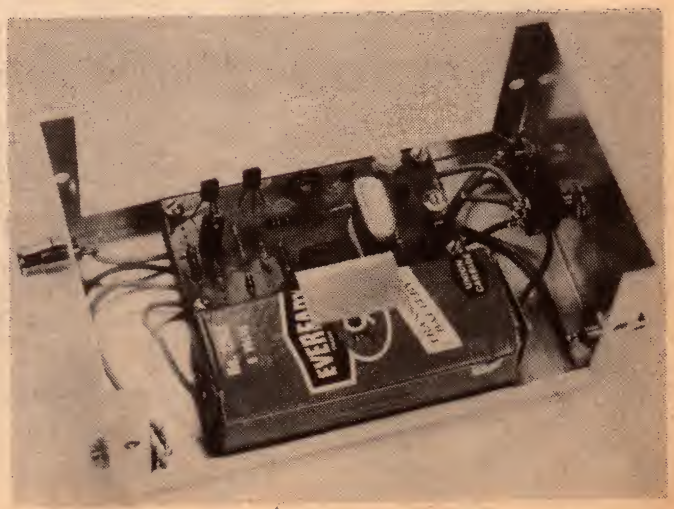
By the time this appears in print, the printed board should be available from the usual sources. There should also be no problems in obtaining the IC and the transistors. Any transistor similar to the BC548 should be satisfactory. We used a tantalum 1uF capacitor to couple into the Darlington pair but an ordinary electrolytic of similar ratings may be substituted. The 33pF N750 ceramic should be used if possible. Alternatively, an NPO ceramic may be substituted with some slight deterioration of time keeping due to temperature changes.

The two trimmers in the prototype are made by Cermet and these should be used where possible. However, the Philips series of plastic trimmers will fit the board and should be a satisfactory substitute. Some variation in capacitance value may have to be tolerated here but maximum values of 40pF and 10pF should be OK.

The crystal is one of the most important components of all but no problems should be experienced in getting a suitable one. The one shown in the prototype came originally from Dick Smith. This crystal is one of the larger packages and may not be currently available from this source.

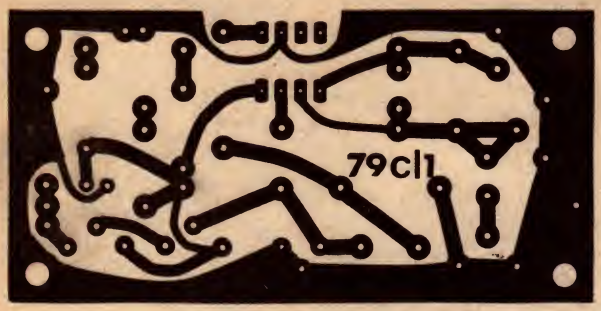
However, there is a smaller package available from Dick Smith and these should be readily available. The pin spacings are different for the two packages but the printed board has been made to take either type.

Construction is only a small job and should require only a short time. Take care not to overheat components while soldering but, at the same time, make

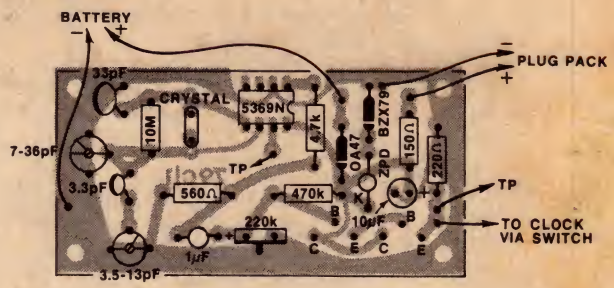


A single printed circuit board accommodates most of the components. Socket at top left is the clock drive output, while the DC supply input is at lower left. Sockets on right are: one to pin 7 of the IC, and one in parallel with the output socket.

Quartz crystal clock driver



For those readers who make their own boards, here is an actual size reproduction of the PC pattern.



This overlay diagram shows the PC board as viewed from the component side. Pay attention to polarised components.

sure that good joints are made. Leave the 1uF tantalum capacitor off the board until final setting up.

The 5369 IC should be left until last. If you do not use a socket, the 5369 should be soldered in place with the barrel of the soldering iron connected to the earthy copper on the board.

With the board completed, check to make sure that all components are in the right places and that all polarities have been observed. On the prototype box we fitted two sockets at one end, one to suit the DC supply input and the other for the clock drive output. At the other end we fitted the output switch and two more sockets, one across the output and the other to the crystal oscillator output from pin 7.

A small bracket is needed to hold the battery and we made one from a scrap of aluminium. It, and the battery, are best fitted before mounting the board. The board sits alongside it, supported by four brass spacers, as shown in the photograph. Before fitting the board, check that all leads for external connections have been fitted. Do not connect the battery at this time.

The unit is now ready for adjustments. Set the two trimmers and the 220k trimpot to their mid points. Plug in the plug pack and switch on. Measure the voltage delivered by the plug pack, and select the dropping resistor as already explained. The regulated supply should be 9.5V, plus or minus 5%.

Check the DC voltage across the 220 ohm resistor at the output of the Darlington pair. It should be set to 1.0V by means of the 220k trimpot. At this stage switch off and fit the 1uF tantalum coupling capacitor.

Before attempting to run the clock from the driver unit, fit a normal dry cell and run it for a few days. If necessary, regulate it until it keeps within 10 seconds per day.

To connect the clock movement to the driver use a length of audio type coax cable fitted with an RCA plug at one end and crocodile clips at the other. Plug it into the driver and connect to the movement in place of the 1.5V dry cell. Make sure that correct polarity is observed.

Switch on the power supply and switch on the movement start switch. The movement should start after a delay of one to two seconds. When the movement is switched off it may take up to 30 seconds to stop. These points must be taken into account when setting up the clock for correct time.

Set the second hand about two seconds past the 60 and, with the movement start switch off, wait for an appropriate time signal and switch on. An ideal time signal is provided by VNG on 7.5MHz and 12MHz (day) or 4.5MHz (night). If this is not available, use a time signal on the hour from one of the broadcast stations, or the Telecom telephone time service.

When the clock is running, I suggest that you check its time daily to see that it is regulated correctly. If you have already adjusted the crystal frequency against a good counter, the clock should run well within one second per day. If not, the drift should be no more than one second per day and this error should be adjusted very carefully with the 7-36pF trimmer.

With the clock regulated thus far, which may take several days, its performance should be checked over several more days to see which way it is going. Any small drift should then be corrected with the 3.5-13pF trimmer. From here on it is up to the individual to decide just how far he will pursue the adjustment procedure.

If, after initially starting the clock it is found that after the first day it has gained or lost several seconds, it means that the movement is not synchronised and it should be regulated by means of the screw adjustment at the back of the movement.

Having set up your clock it should keep time within the limits of the crystal oscillator and the degree to which it has been adjusted. Suffice it to say, it should be reasonable to expect no more than one second drift over a period of about 11 days, which is equal to about one part in one million.

PARTS LIST

1 Aluminium box 133mm x 76mm x 54mm
1 Printed board 76mm x 38mm code 79cl1
4 Rubber feet
3 RCA sockets, single hole mounting
1 Miniature toggle switch SPDT
1 Plug-pack with nominal 9V DC output
1 Socket to suit DC plug on plug-pack
1 9V battery No 2362
4 Brass spacers, ⅜in long tapped ⅛in Whitworth
1 MM5369 oscillator/divider 8-pin DIL
1 Socket 8-pin DIL
1 Crystal 3579.545kHz
1 OA47 diode (see text)
1 ZP3.3 zener diode
1 BZX79C6V2 zener diode
2 BC548, or similar transistors
1 220k Philips miniature trimpot

RESISTORS (½W)
1 x 150 ohms or 220 ohms (see text), 1 x 220 ohms, 1 x 560 ohms, 1 x 4.7k, 1 x 470k, 1 x 10M

CAPACITORS
1 3.3pF NPO ceramic
1 33pF N750 ceramic (see text)
1 3.5-13pF Cermet trimmer
1 7-36pF Cermet trimmer
1 1uF 35VW tantalum
1 10uF 16VW electrolytic

MISCELLANEOUS
Hookup wire, solder, screws, bracket for battery, battery connector clips.
Note: Resistor wattage ratings and capacitor voltage ratings ar those used in the prototype. Components with higher ratings may generally be used provided they are physically compatible. Components with lower ratings may also be used in some cases, provided the ratings are not exceeded.

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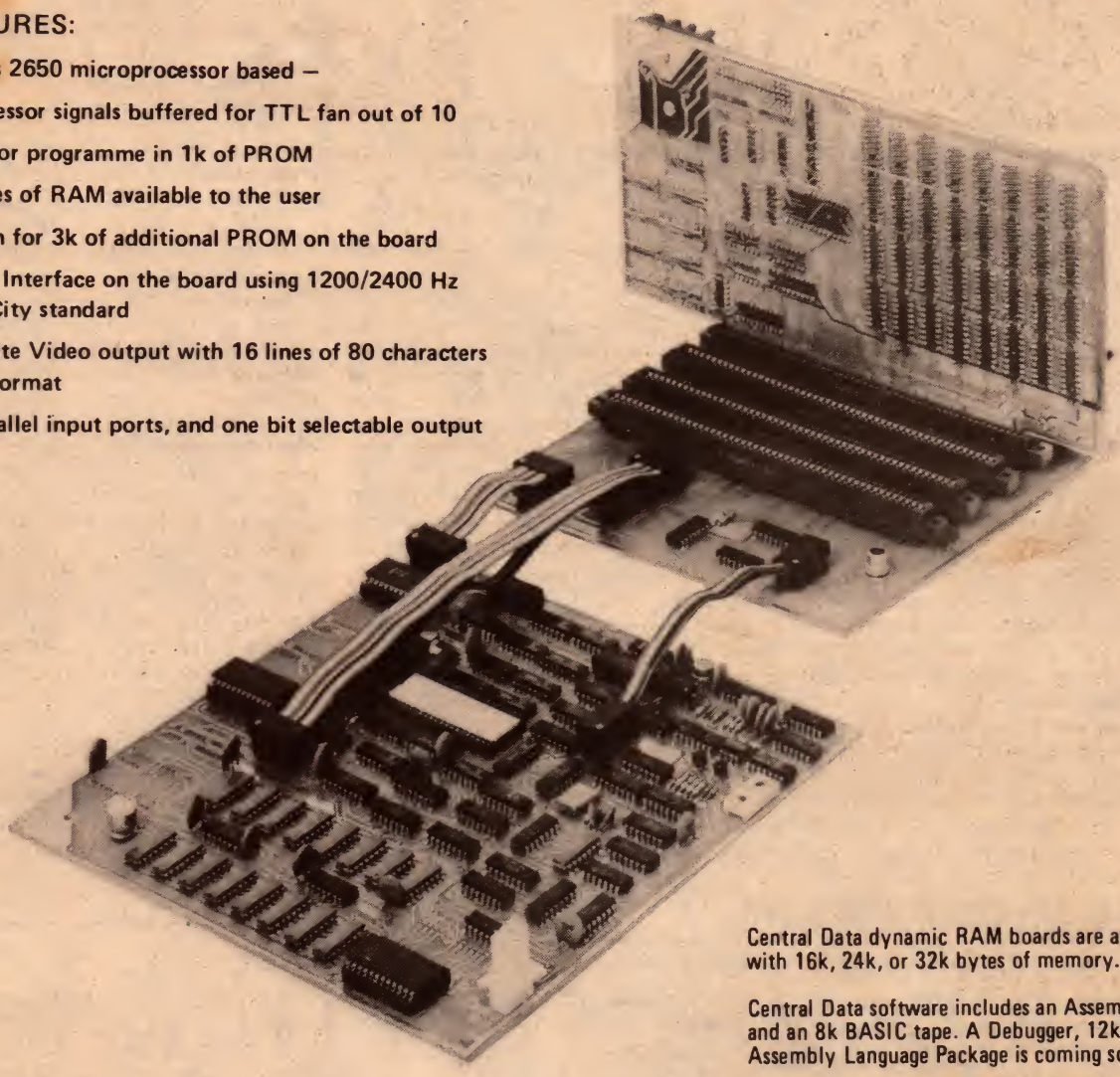

The Central Data System Board CDYSBDA facilitates the writing of programmes in Hexademical with only the addition of a TV monitor, ASCII Keyboard and power supply.

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Central Data dynamic RAM boards are available with 16k, 24k, or 32k bytes of memory.

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MO808/778

Special offer + nine simple projects

20 transistors for $2.50!

Here's an offer that's simply too good to refuse — 20 small signal silicon transistors for just $2.50, or a little over 12 cents each! To help you take advantage of this special price, we describe here a number of simple projects which use the offer transistors extensively.

This special transistor offer comes from — you've guessed it — Dick Smith Electronics Pty Ltd. The transistors are available only in packs of 20, each pack containing five BC237s, five BC238s, five BC307s and five BC558s. As far as the projects described here are concerned, these may be considered equivalent to types BC107, BC108, BC157 and BC158 respectively (see data table).

At $2.50 for the pack, Dick's price is particularly good value, especially when one considers that the normal price for 20 transistors of this type would be around $5.80!

Dick Smith emphasises that the devices are in no sense factory rejects or "seconds". The transistors are all made by Siemens, and are standard quality items which meet all the manufacturer's specifications. The offer is simply because Dick has been able to purchase 200,000 of the devices at a rock-bottom price. It will remain open until stocks are exhausted.

To take advantage of the offer, all you have to do is fill out the coupon which appears at the end of this article and take it — with your money — to Dick Smith Electronics. Note that the price quoted in the introduction applies only to over-the-counter customers. Mail order customers can still take advantage of the offer, but should add another 50 cents to cover postage and packing.

As you can see from the data the BC237 and BC238 transistors are NPN types and, in the circuits presented here, may be freely interchanged. The same comment on interchangeability applies to the BC307 and BC558 PNP types.

It is also worth remembering that you can substitute PNP transistors in those circuits using only NPN types, provided you reverse the polarity of the power supply rails and reverse other polarised components (diodes and electrolytic capacitors etc). The circuits which lend themselves most easily to this approach are the amplifier and the fuzz box.

Whatever you do, make sure you connect the transistors into the circuit with the correct lead configuration. An incorrectly wired transistor will not only refuse to function, but may be damaged as well! Follow the lead wiring diagram shown next to the data table.

Simple Moisture Alarm

This device will not stop the rain, but at least it will help the lady of the house to get the washing dry — by sounding a strident alarm when the rain starts. Besides acting as a rain alarm, the device could be used as a bed-wetting alarm, an excessive condensation indicator, a pool splash alarm, a novel form of doorbell system or as an indicator that the bath water is at its correct level. The applications for a reliable moisture detector are many and varied.

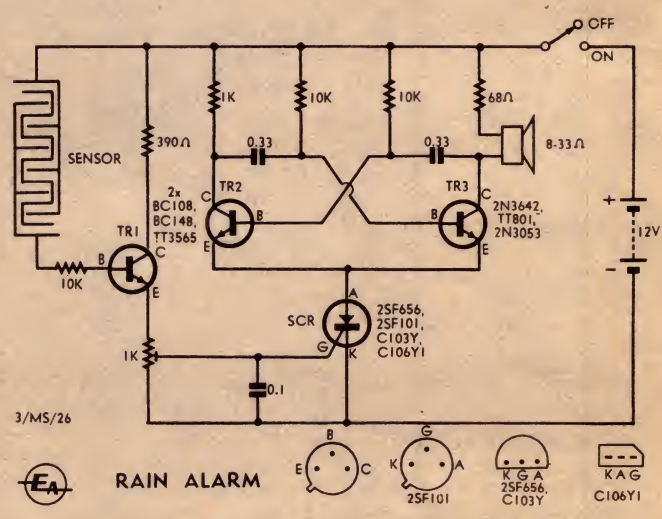
Basically, the unit consists of a moisture sensing element, an NPN silicon transistor which conducts in proportion to the amount of moisture on the sensor element, and an SCR which is triggered when the current through the transistor rises above a set value. When the SCR conducts, it applies power to a two-transistor multivibrator which has a loudspeaker as part of the collector load of one of the transistors.

Once the SCR has triggered, the alarm will continue to sound until it is turned off.

Our sensor was made from Veroboard. For those not familiar with the product, it is a phenolic composition board with parallel copper strips bonded to one side, small holes being punched at regular intervals along the copper strips.

What we have done is to connect alternate copper strips to form interlocking grids. There are actually three grids on the board, with no connection between. One grid is connected to the positive supply, one grid connected via a resistor to the base of the transistor, and the third is left "floating".

By having three "grids" on the sensor, the unit becomes more reliable as a rain indicator. With a simple sensor one raindrop could reduce the open-circuit resistance and allow

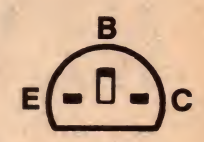


Here are the transistor specifications:

Type	Case	Polarity	Vce	Vcb	Ic (mA)	Hfe	Ft (MHz)	Power (mW)	Equivalent
BC237	TO-92	NPN	45	45	100	120-220	250	220	BC107
BC238	TO-92	NPN	20	20	100	120-220	250	220	BC108
BC307	TO-92	PNP	45	50	100	75 min	150	300	BC157
BC558	TO-92	PNP	25	30	100	180 min	150	500	BC158

the alarm to be triggered. This would mean that on overcast days when there is sometimes light intermittent "sprinkling" the unit could be triggered by just one drop, constituting a "false alarm". By having three grids, a minimum of two raindrops is required to trigger the unit — the two raindrops have to "bridge" appropriate copper strips for triggering to occur. This feature, in combination with the sensitivity control, allows the unit's sensitivity to be set for reliable triggering on anything from a light shower to quite a heavy downpour.

Follow this diagram when wiring transistors into circuit

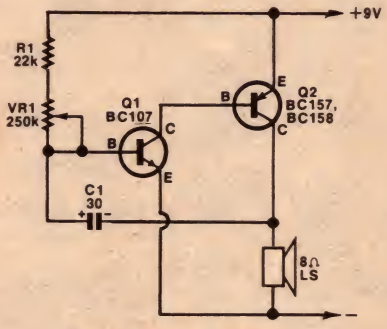


Make sure that you solder the transistors into circuit with the correct lead configuration. An incorrectly wired transistor will not only refuse to function, but may be damaged as well. The above diagram shows the lead configuration of the offer transistors as viewed from below.

Mini Metronome

Here is a really simple project — a unit that simulates beautifully the sound of a time bomb ticking away! For those more attracted to gentler pastimes it may also serve as a metronome, that is it gives a loud click at regular intervals, the actual interval being varied by a potentiometer in the circuit. It's very simplicity also makes it highly suitable for use as an audio warning device with the alarm switch inserted in the supply line.

The actual working of the circuit is fairly simple; on applying a voltage across R1, VR1, C1 and the loudspeaker, capacitor C1 charges up till a point is reached when Q1 switches on. This in turn switches Q2 to a conducting state — meaning that a voltage



MINI METRONOME

is applied across the loudspeaker causing it to "plop".

The base current of Q1 reduces the charge on C1 to the stage where the transistor turns off; thus the cycle starts all over again. The rate at which C1 charges depends upon VR1 and by altering this the interval between the cycle can be varied.

A wide variety of transistors may be used for Q1 and Q2. Q1 is an NPN transistor and may be either a BC237 or a BC238. Q2 is a PNP type and can be either a BC307 or a BC558.

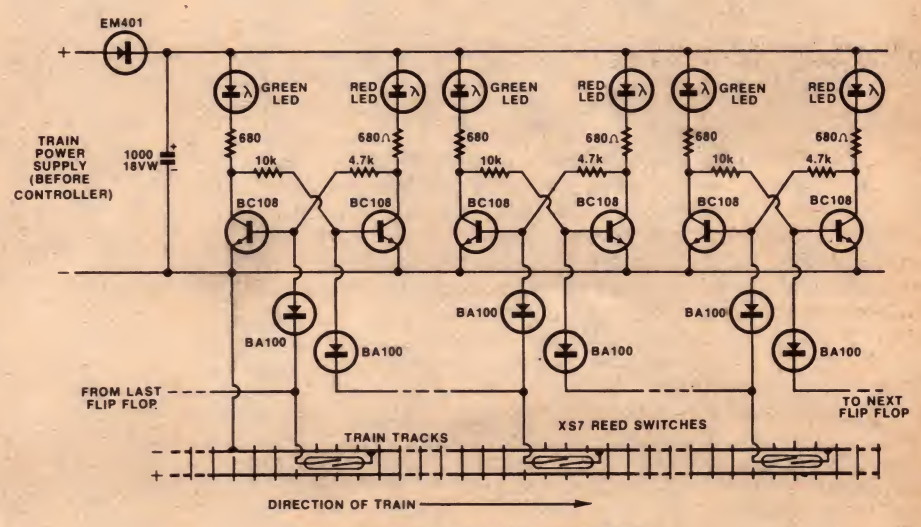
The components are mounted on a small piece of Veroboard. One end is drilled to take the potentiometer and the other components are mounted and soldered at the other end. The project is so simple that very little can go wrong and immediately you switch on regular "plops" will be heard. By altering VR1 a wide range of intervals should be covered but if you want slower ones — that is with several seconds' interval — increase the value of C1. If you want faster ones, lower its value.

Model Train Signaller

One of the most useful devices for the model railway enthusiast is the reed switch, a simple and extremely reliable unit which can be located between the rails of a track and used to sense the passing of a train. A small magnet mounted under the loco will trip these switches. One very obvious application is to operate an automatic signalling system.

A suitable system is shown in the accompanying circuit. It is based on a two-transistor configuration called a "flip-flop", one being needed for each signal.

It uses a basic signalling system employing two light emitting diodes (LEDs) — red for stop and green for go — and any signal remains on green until a train passes it, whereupon it changes to red. The signal remains on red until the train has cleared the next section of track, that is, up to the next signal. When the next signal changes to



MODEL TRAIN SIGNALLING SYSTEM

red the first signal reverts to green.

Each reed switch is connected to two flip-flops, isolated from each other by silicon diodes. These diodes stop unwanted interaction between signals behind the train.

When the train passes over the reed switch, the contacts close, connecting together the base and emitter of the associated transistors. The forward bias is removed, cutting each transistor off and forward biasing its partner.

Coming Soon!

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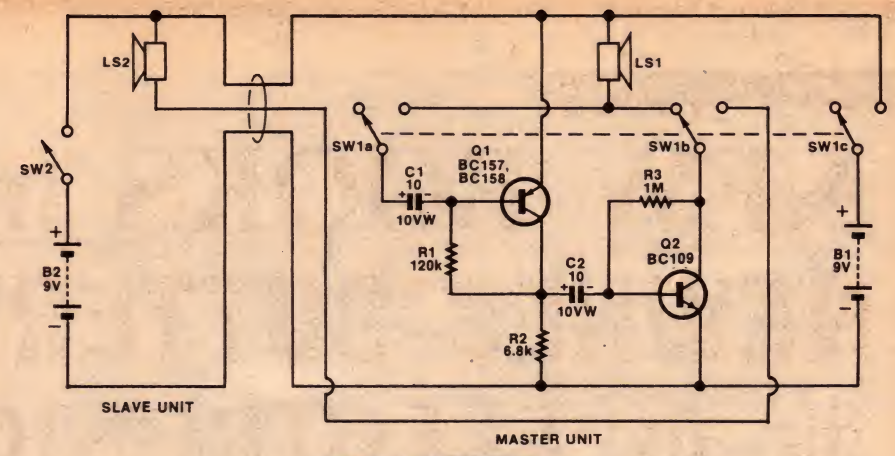
Simple Intercom

Many readers could, no doubt, find a use for an intercom, but doubt whether the expenditure on a commercial unit would be justified. The unit described here is a relatively low-cost project. It can easily be used as a baby alarm — it is certainly sensitive enough — merely by switching one of the units on permanently.

The unit is not fitted with a buzzer as calling over the unit is usually enough to draw the attention of the distant party. It cannot be used for eavesdropping (an undesirable, "Big Brother" type feature) and thus its installation can cause no offence.

The basis of the intercom is a simple amplifier which boosts the "microphone" output to feed a speaker.

The amplifier is slightly unusual and is very simple. It uses a PNP and an NPN transistor and is RC coupled. The switching is straightforward; two batteries are used, one each in the master and slave section.



SIMPLE INTERCOM

In the normal position (as shown in the circuit diagram) no currrent is drawn and the switch on the master is set to receive calls from the slave. The only thing the slave has to do is apply battery voltage to the master by making SW2.

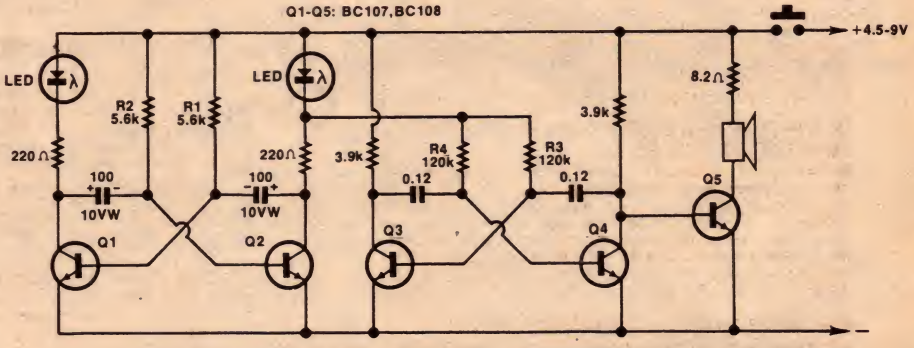
When the master makes a call the output from the amplifier is fed to the slave loudspeaker, its own loudspeaker is switched to the input, becoming the microphone, and the slave's microphone becomes the loudspeaker. The master unit will, of course, override the slave.

Hee-Haw Siren

This hee-haw siren can be installed in a toy fire engine or police car in order to provide a more interesting and realistic toy. Although many siren circuits have been described, this one has the advantage that it also provides one or two flashing beacons.

Transistors Q1 and Q2 form a multivibrator with a period of about 0.6 second, flashing the LED beacons and "frequency moduiating" and multivibrator formed by Q3 and Q4. Q5 amplifies the output and drives the speaker.

A small speaker from a scrapped transistor radio can be used for the output transducer. If a speaker with an impedance greater than 22 ohms is used, the series resistor may be omitted. If only one beacon is required, the LED in the collector circuit of Q1 may be omitted and the 220 ohm resistor increased to 560 ohms.



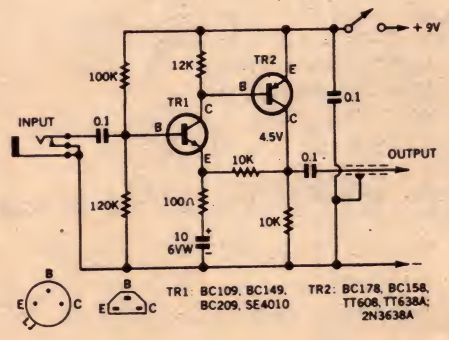
HEE-HAW SIREN FOR TOYS

Microphone Preamplifier

This handy microphone preamplifier circuit can be built on a printed board (no. 72/p2) measuring 64 x 54mm. It has a voltage gain of 100 and draws only 0.45mA at 9V, which can be supplied from a small battery. Alternatively, supply can be obtained from a convenient positive point in the associated amplifier, through a dropping resistor.

If supplied through a dropping resistor, the 0.1*u*F capacitor should be replaced by an electrolytic bypass of 50*u*F or more at a working voltage of 12VW or more.

A conventional circuit configuration is used. An NPN and a PNP silicon transistor are connected together in a direct coupled feedback-pair arrangement with both transistors operating as common-emitter amplifiers. Negative feedback is applied from the collector of the PNP transistor, TR2, to the emitter of the NPN transistor, TR1, via a 10k resistor. The ratio of the 10k resistor to the 100 ohm resistor in the emitter circuit of TR1 sets the voltage gain of the circuit to 100.



Input impedance of the circuit is close to 50k, set by the parallel combination (to the input signal) of the bias resistors for TR1. As such, it is suitable for dynamic microphones requiring a load of 50k. It can also be used to follow low output impedance FET preamplifiers for condenser microphones.

Note that although BC237 and BC238 transistors can be used for TR1, individual transistors may prove somewhat noisy in this application. Try substituting for best results. If this proves unsatisfactory, then you will have to use a branded low noise transistor such as a BC109 or BC549. Transistor TR2 may be either a BC307 or a BC558.

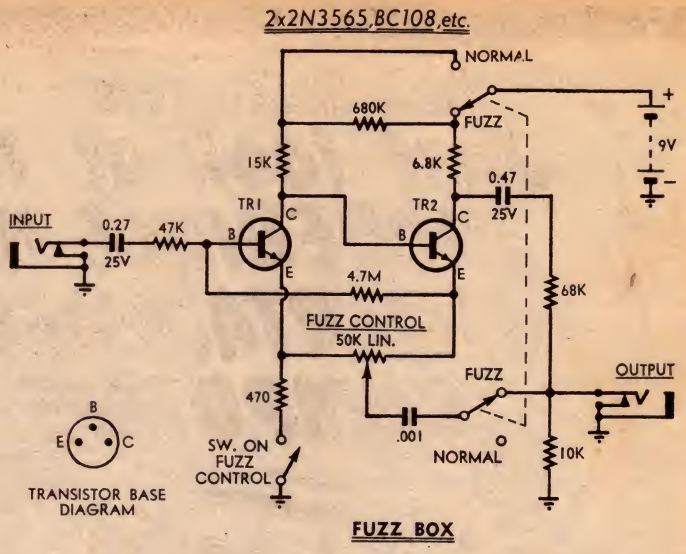
Physically, the preamplifier should be mounted inside a metal box connected to the negative supply line to combat hum and penetration of radio and TV signals. The microphone input lead should be a shielded type, as also the connection to the main amplifier.

Fuzz Box

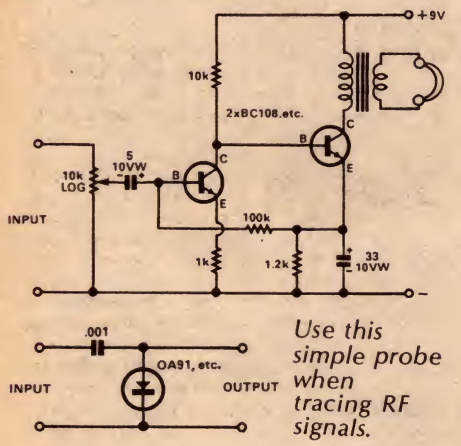
For the guitar enthusiast, this simple device will have a lot of appeal. Using two BC108s (or BC238s) and a few resistors and capactiors, it can be built for a modest cost. It is designed to be interposed between the guitar and the main amplifier, thus confining the "fuzz" effect to the guitar signals only. A foot switch allows selection of "fuzz" or "normal" as required; the level remains much the same in both modes, the degree of "fuzz" is variable, and the unit provides a small amount of gain.

The unit can provide a wide range of wave shapes, from simple half wave clipping to complex peaks. As well as the unit's own control, the guitar's volume control can be used to vary certain aspects of the waveform.

The unit is battery powered, thus making it completely self-contained. The prototype was built into a small metal box with a sloping front on which the foot switch was mounted, the whole unit being designed to sit on the floor near the player's foot. Most of the circuit can be built on a short length of tag board, or strung between it and the input and output sockets, controls, etc.



Two Stage Amplifier & RF Probe



Use this simple probe when tracing RF signals.

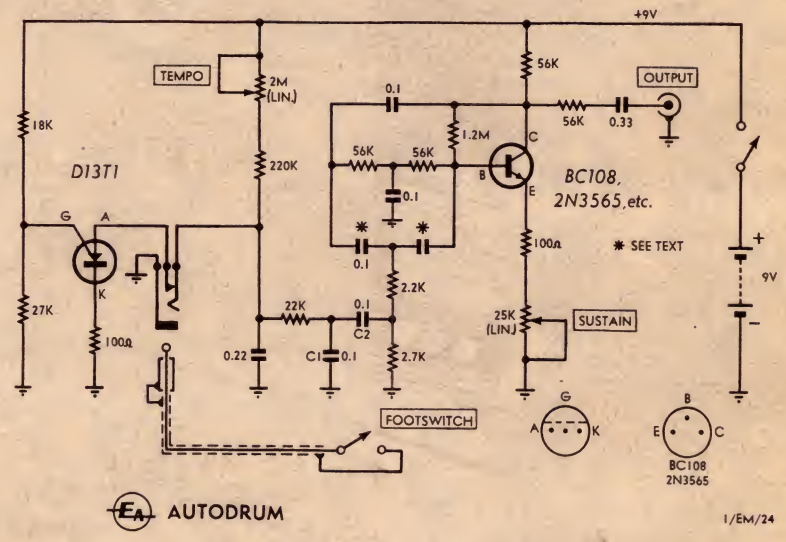
This simple two-stage audio amplifier with volume control has several applications. It can be used as a general purpose amplifier to amplify the output of such things as crystal sets; it can be used for tracing signals in audio circuits; and, when coupled to a suitable probe, can be used for tracing modulated RF signals.

The circuit employs just two NPN transistors, and can be built on a small piece of Veroboard. Layout is non-critical. The output transformer is a type commonly employed as a speaker transformer in valve equipment, and should have a primary impedance of 5000-7000 ohms and a secondary of 8-16 ohms.

When the amplifier is to be used for signal tracing an isolating capacitor of about 0.1uF, 400V, should be connected in series with the active input terminal (top of the 10k pot).

In order to trace modulated RF signals it is necessary to precede the amplifier with a detector or RF probe. Such a device is simplicity itself, and consists of only two components, as shown above.

Autodrum



This simple unit generates a drum-like damped oscillation which sounds most impressive when fed into a higher power amplifier. It uses only two solid state devices, one of which is a BC108 (or BC238) and the other a programmable unijunction transistor (D13T1).

The beat rate may be determined in two ways; directly by the musician operating a foot pedal in much the same manner as for a real drum, or by means of the tempo control.

The whole unit can be accommodated in a small plastic box and powered from an internal battery. The tone of the drum can be varied over a wide range, from a bass drum to a kettle drum, or even imitate a set of tom-toms.

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Build your own 3½ digit LCD digital voltmeter

Intersil ICL 7106 DVM evaluation kit

Using a new Intersil evaluation kit, you can now build a single chip 3½digit liquid crystal display digital panel meter. In this article, we review the kit, and give details of how to use it to construct a simple 10 megohm input impedance voltmeter.

by DAVID EDWARDS

At the heart of this project is the Intersil 7106 LSI chip. This 40-pin device contains a precision dual slope analog to digital converter, BCD to seven segment decoders, liquid crystal display drivers, a clock generator and a reference voltage. To build a high performance digital meter it is only necessary to add a display and a handful of passive components.

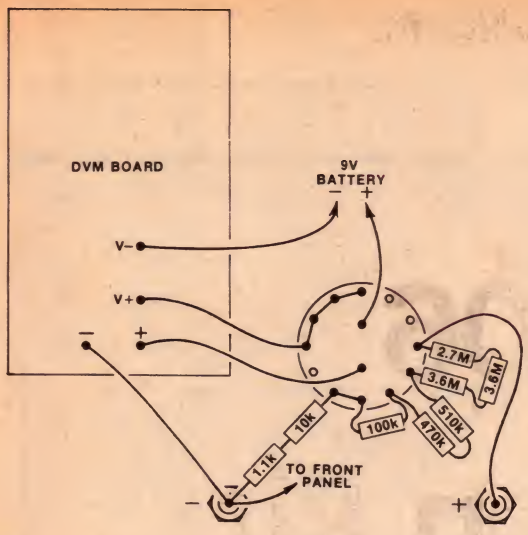
Features of the 7106 chip, which is a single CMOS device, include a guaranteed zero reading for a 0V input, automatic polarity indication, 1pA typical input current, true differential test and reference inputs, and low power dissipation — typically less than 10mW. In fact, operation from a single 9V battery is quite feasible.

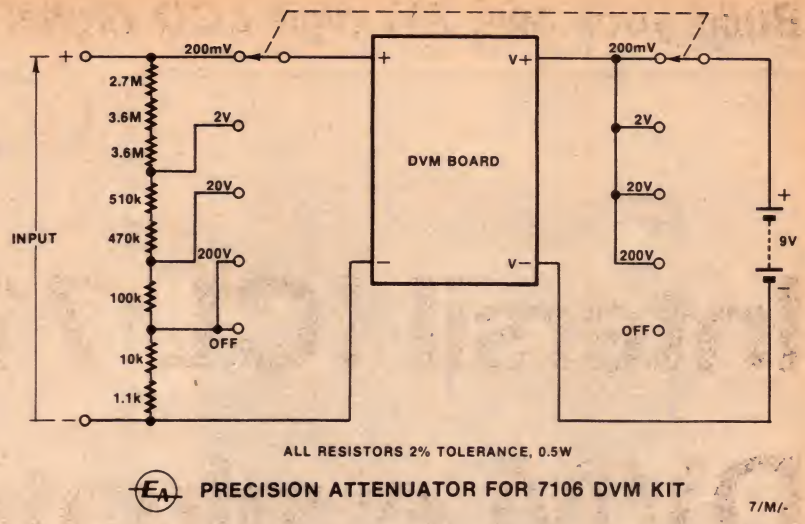
The evaluation kit, coded ICL7106EV/KIT, has a recommended retail price of $39.10, and enables a 0 to 200mV DC meter to be built in less than half an hour. All parts are included apart from a 216 type 9V battery.

A single sided, screen printed circuit board is provided, measuring 89mm x 126mm. All components mount on this, including the battery (a clamp is supplied). A 40-pin socket is provided for the 7106, and Molex connectors for the display.

The display is a liquid crystal type with 3½ digits 12.5mm high, polarity indication, and decimal points. These latter are not used in the basic kit. The display has 40 connection points, arranged in a wider than normal dual in line arrangement.

This photograph shows an assembled kit, and the components required to construct a second kit. Note the battery clamp.





PRECISION ATTENUATOR FOR 7106 DVM KIT

7/M/-

ABOVE: This diagram shows how the additional components for the attenuator are mounted on the switch.

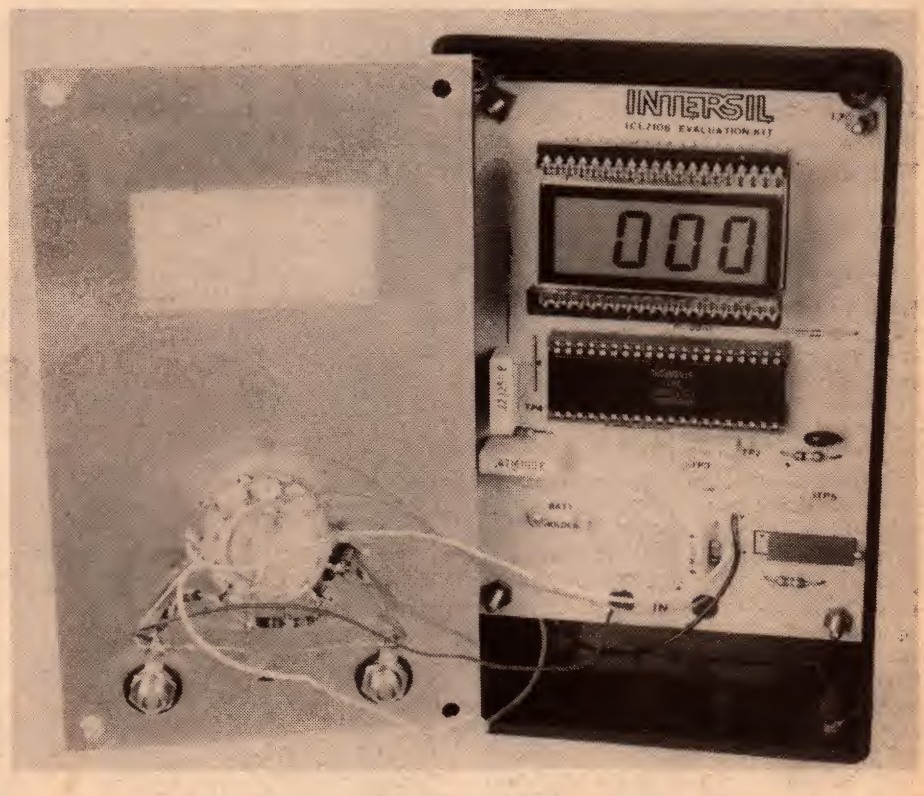
BELOW: This photograph shows the completed DVM. The batteris mounted underneath the printed circuit board.

ABOVE: The circuit diagram of the attenuator, and of the power supply switching, is shown above.

A 10-turn trimpot is provided to trim the reference voltage, and is adjusted to give a full scale reading of 200mV. To change the full scale reading to 2V, several passive components are required to be altered. Details of the changes required are given in the literature accompanying the kit.

Construction of the kit is quite simple, and should present no problem. Care is required when fitting the display, as there is no pin 1 indication. If you view the display in reflected light, you will be able to see the individual segments. The half digit (+1) goes on the left hand side, when the PCB is viewed from the component side with the terminals at the bottom.

To test the completed board, connect up a battery (watch the polarity), and check that the display becomes active. With the inputs shorted, the reading should zero, with the minus sign coming on about half the time.



PARTS LIST

1 Intersil ICL7106EV/KIT DVM evaluation kit
1 Zippy box, 159 x 96 x 53mm
1 2-pole 6 position rotary switch
2 20-pin SIL wire wrap sockets

RESISTORS (½W, 2%)
2 3.6M, 1 2.7M, 1 510k, 1 470k, 1 100k, 1 10k, 1 1.1k

MISCELLANEOUS
1 knob
1 216 type 9V battery
Solder, hookup wire, machine screws and nuts, spacers

NOTE: Resistor wattage ratings and capacitor voltage ratings are those used for our prototype. Components with higher ratings may generally be used provided they are physically compatible.

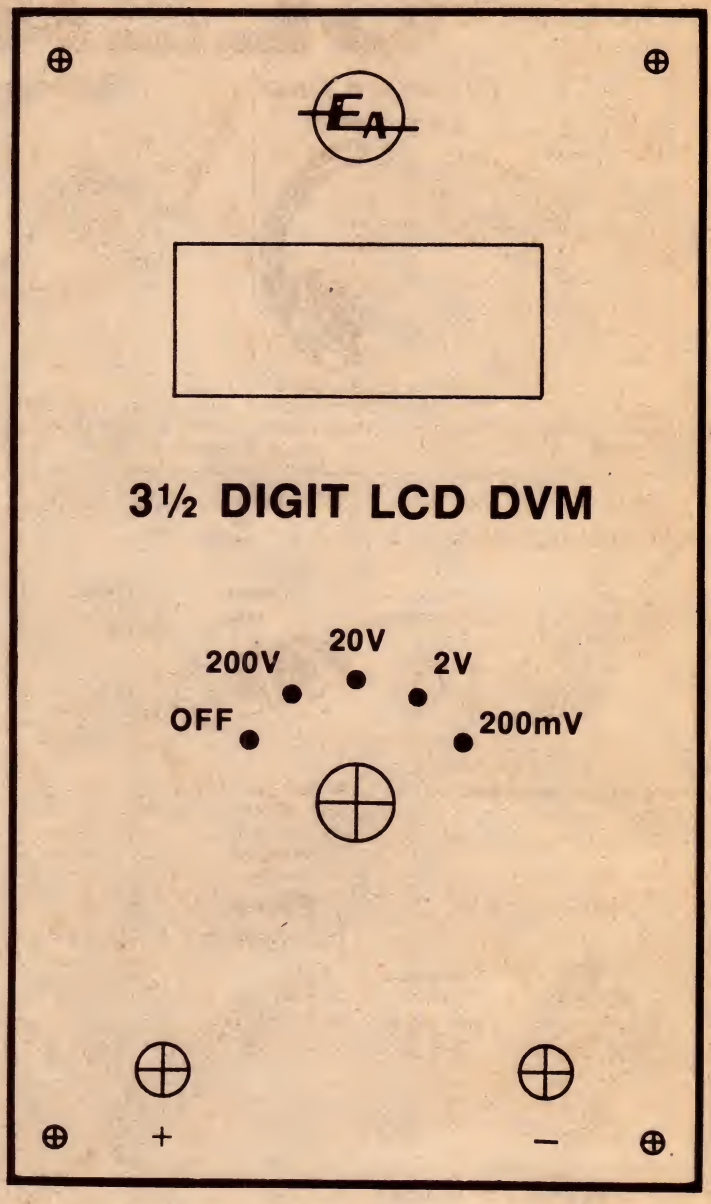
In order to produce a more useful instrument, we built the kit into a small plastic and aluminium box, and fitted a precision attenuator to extend the measuring range up to 200V full scale. In order to do this it was necessary to raise the display up from the PCB, so as to provide clearance for the switch.

We did this by using single in-line wire wrapping sockets, which have tails approximately 15mm long. This gives sufficient clearance for the switch, provided that the switch lugs are bent over as much as possible. The PCB is mounted on spacers so that the top of the display is just below the front panel of the box.

The terminals provided with the kit are transferred from the PCB to the front panel. Connect the front panel to the negative terminal using a piece of tinned copper wire fastened underneath the switch bush.

We used photosensitive aluminium to make a front panel for the unit. The artwork we used to reproduced elsewhere in this article. It would also be possible to letter the panel using pressure sensitive lettering, protected with a coat of clear lacquer.

Drill a clearance hole in the side of



The completed DVM is shown above, while the artwork for the front panel is reproduced actual size at the right. This can be useddirectly if required. An alternative to this panel would be to use pressure sensitive lettering.

the case so that the calibration trimpot can be easily adjusted. It may also be necessary to remove the internal ribs from the box (use a sharp chisel), to allow clearance for the PCB.

The resistors we used for the attenuator are all 2% tolerance types, and are available from Radio Despatch Service, of 869 George Street, Sydney NSW. This firm also has stocks of the basic DVM kit and the wire wrap sockets.

Mount the resistors around the switch, keeping them close to the front panel, so that there will be adequate clearance for the PCB. Complete the connections to the PCB using light gauge hookup wire. It may be necessary to extend one of the leads from the battery clip. Remember to insulate the joint, to prevent short circuits.

To calibrate the complete DVM, you can use a new mercury cell, of the type used in cameras and hearing aids. When these are new and fresh, they have an open circuit terminal voltage of 1.355V. Adjust the trimpot till this reading is obtained on the 2V scale.

No provision for decimal point switching has been provided, as this would require an extra pole, and hence a larger switch. In addition, an extra IC is required if the display is not to be damaged. (See the literature accompanying the basic kit for more details on this point.)

We have not provided extra functions for the unit, as this adds considerably to the complexity and the cost, and makes the complete unit unattractive in comparison with commercial DVMs.

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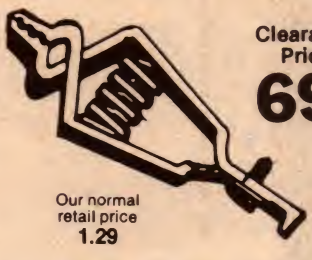

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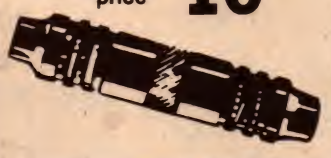
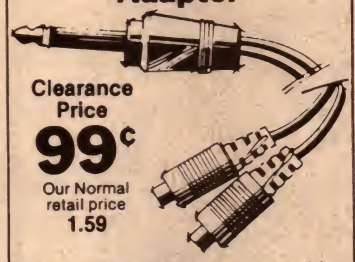


Allows two cables terminating with miniature phone plugs to be connected together. Shielded type. 274-298

Flexible "Y" Adaptor



Clearance Price **99¢**

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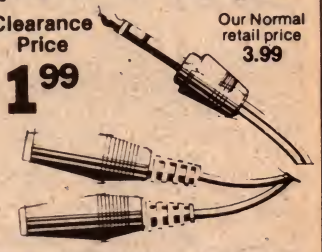
Two phone jacks connected in parallel to a standard ¼" plug. 5¾" long. 274-306

Dual Stereo Headphone "Y" Adaptor

Clearance Price **1.99**

Our Normal retail price 3.99



One end has two ¼" phone jacks, connected in parallel to ¼" phone plug. 10" long. 274-319

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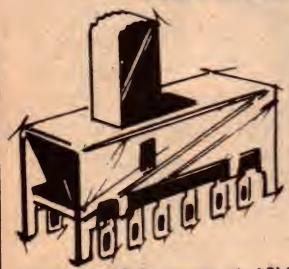
Gold-colour aluminium-alloy with black base, concave top, faceted grip. 2.69cm dia. 1.9cm deep. Double set screw. 274-422

4-Pole DT Miniature Slide Switch



Clearance Price **10¢**

Our Normal retail price 99¢

Contacts 0.3 amps at 12VAC. Size 3.17x .95x1.42cm. 275-405

Mini Audio Amplifier Chassis

Our Normal retail price 4.95

Clearance Price **2.95** *350mW output, 5 transistors*

Dual inputs: 5,000/10,000 ohms. For 8-12 ohm load. 10.16x5.08x1.9cm. 15,000 Hz. 277-1557

Mini Test Clips

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Black. 5.08cm long **278-1158**

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Eliminate troublesome whistles from your AM tuner

9kHz Whistle Filter

Since AM broadcast stations in Australia are now spaced at 9kHz intervals, the problem of heterodyne whistles is more severe than before. The whistle filter featured here was originally designed to suit the new Playmaster Digital AM/FM Tuner, but will suit virtually any tuner with a 9kHz whistle problem.

by LEO SIMPSON

Previously, with the 10kHz AM station spacing, whistles were not a problem unless the listener had a tuner of reasonable bandwidth, loudspeakers of fair quality and ears of equally fair acuity. Now, however, with 9kHz AM station spacing, tuners of only modest bandwidth can present even less sensitive ears with a whistle problem.

Whistles will normally be more noticeable at night, when reception conditions are improved. This allows distant stations to be picked up with sufficient strength to cause interference with local stations. If you listen to the radio only during the daytime, it is unlikely that you will notice any whistle problem.

How does the 9kHz whistle become audible? This is best understood by a brief consideration of the superheterodyne principle which is used in most radios. After passing through a tuned input circuit (which may involve a ferrite rod aerial) and perhaps an RF stage, the incoming radio frequency is mixed with the local oscillator of the radio to produce an intermediate frequency of 455kHz.

The 455kHz signal is amplified in one or more IF stages and then passed to a detector, which is usually a diode, to recover the amplitude modulation. A simple RC filter removes most of the rectified 455kHz signal to leave the audio modulation.

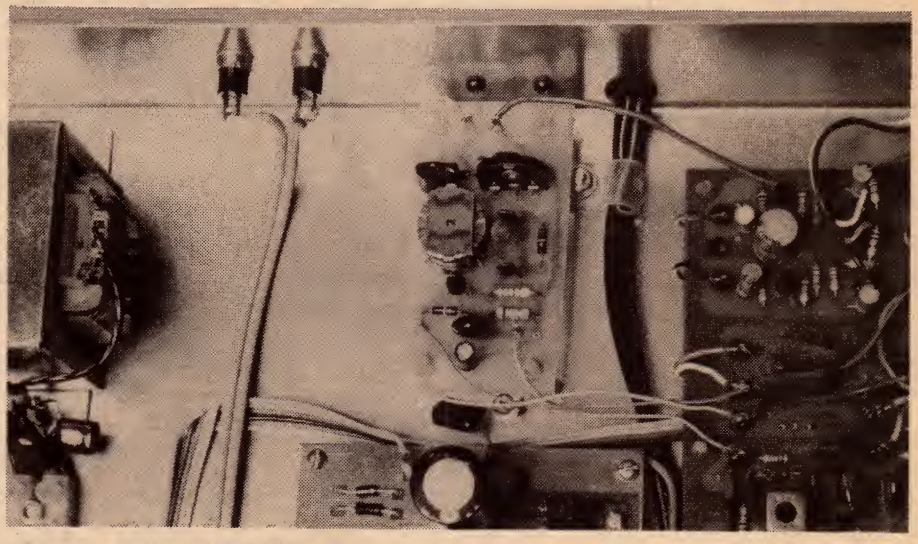
When two stations separated by 9kHz are received and fed together to the mixer, any sum and difference products other than those close to 455kHz are removed by the following IF stages. But if the tuner has a bandwidth of say, 10kHz at the —3dB point, the IF stages will pass frequencies between 445kHz and 465kHz.

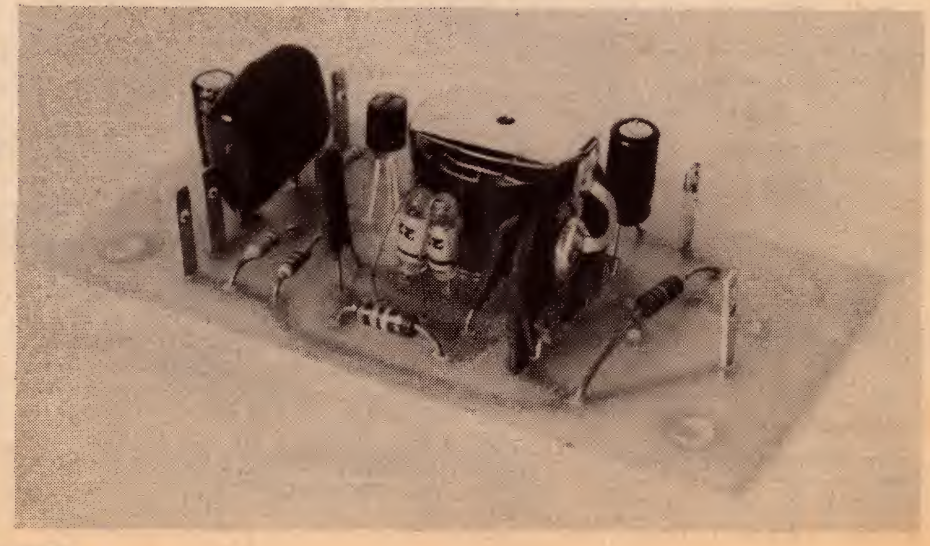
So if the desired incoming station beats with the local oscillator to produce 455kHz, the interfering station 9kHz away will produce 464kHz (or 446kHz) as the beat product. These two frequencies, 455kHz and 464kHz are each amplified to the same extent in the IF strip and then rectified in the detector.

Since the detector is a non-linear device, the two frequencies are not only rectified but they are mixed to produce sum and difference frequencies. The sum frequency is removed by the RF filter following the detector, but the difference frequency is 9kHz! Thus it is amplified and fed to the loudspeaker in the normal way.

This problem is solved by inserting a notch filter in series with the output of the detector. The idea is to remove as little of the wanted audio signal as possible, but introduce very high attenuation at the undesired frequency, namely 9kHz.

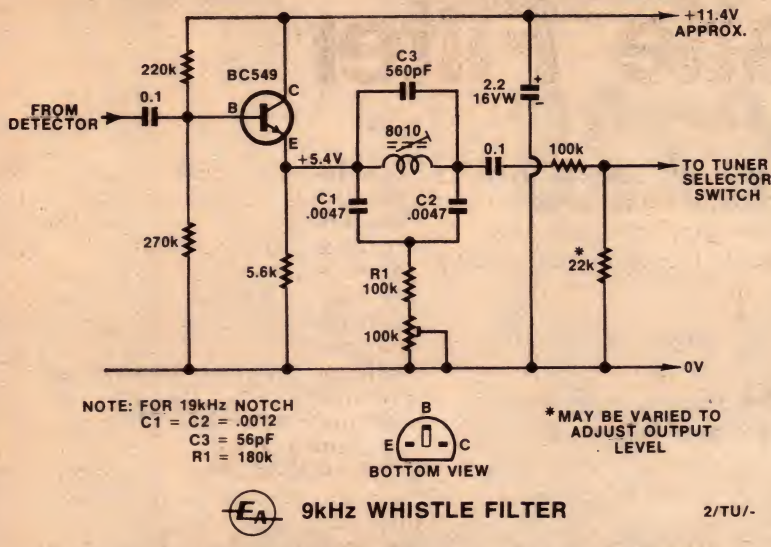
The whistle filter described here uses a high-gain, low-noise transistor connected as an emitter-follower driving a bridged-T network. As used here, the bridged-T network is essentially a parallel-tuned circuit. At resonance, the parallel-tuned circuit is a very high





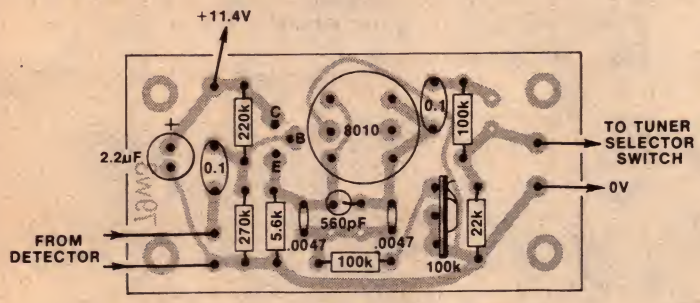
Above is shown the whistle filter installed in the recently described Playmaster AM/FM tuner. Below is a 19kHz version of the filter.

9kHz Whistle Filter



9kHz WHISTLE FILTER 2/TU/-

The circuit is an emitter-follower driving a bridged-T network.



Above is the actual size artwork for the PCB while at left is the component layout for the PCB.

PARTS LIST

1 PC board, 79w3, 40 x 78mm
1 BC549 low noise NPN transistor
1 Jabel 8010 whistle filter coil
1 2.2uF/16VW PC electrolytic
2 0.1uF metallised polyester (greencap)
2 .0047uF metallised polyester (greencap)
1 560pF polystyrene capacitor
Resistors (¼W, 10% tolerance):
1 x 270k, 1 x 220k, 2 x 100k, 1 x 22k, 1 x 5.6k, 1 x 100k preset potentiometer
5 PC pins or stakes

impedance. The adjustable resistor centre-tapped into the capacitive arm of the circuit produces a small phase correction to compensate for the losses in the inductive arm.

The inductor is adjusted to give resonance at precisely 9kHz and the adjustable resistor optimises the null.

As noted above, the whistle filter may be installed in any AM tuner and can be run from positive supplies up to 30 volts DC with no modifications, apart from changing the voltage rating on the 2.2uF electrolytic capacitor.

The circuit is accommodated on a PC board measuring 40 x 78mm, and coded 79w3. Assembly is a straightforward matter requiring little comment.

The whistle filter coil has a nominal inductance of 107 millihenries and is wound on a Neosid ferrite potcore. Made by Transcap Pty Ltd, it is distributed by Watkin Wynne Pty Ltd, 32 Falcon Street, Crows Nest, NSW 2065 under the "Jabel" brand, type 8010. As it has a current retail price of more than $8, we are delighted to report that only one is required!

When the PCB is complete and installed in the tuner, the inductor is adjusted for maximum null by rotating the top section. This has the effect of varying the air gap between the core sections, and thus adjusts the inductance. Since the null obtainable is very sharp, the adjustment is quite critical. Nevertheless, it is possible to obtain a null of more than 50dB using your ears.

Accurately tune to a station which has a 9kHz whistle (at night), boost the treble and volume controls on the amplifier if necessary and adjust the inductor and 100k preset pot for the best null.

The alternative method, using instruments, is actually more difficult. A low distortion oscillator which can be set accurately to 9kHz within ±10Hz is required. If the null is to be better than 50dB down, the oscillator distortion must be less than 0.3%. This is because, when the null is measured, with an oscilloscope or millivoltmeter, the reading is actually the harmonic distortion of the oscillator and buffer stage.

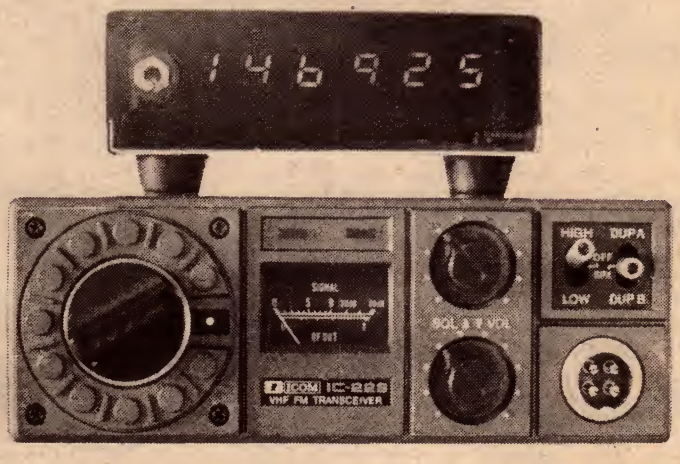
If you have access to an accurate, very low distortion oscillator it is possible to adjust the circuit for 9kHz rejection of 75dB or more.

The circuit may also be used as a 19kHz filter for FM tuners. Two PCBs will be required in this case, one for each channel. The three capacitors and fixed resistor in the bridged-T network need to be changed as follows: C1 = C2 = .0012uF; C3 = 56pF and R1 = 180k.

Fast/slow scanner for the ICOM IC22S

In a previous article the author described a digital readout display for use with the ICOM-22S as either an attachment in its own right, or as a first step towards a combined scanner/readout system. This article describes the scanner and its construction.

by MARK HOPKINS*
VK2BME



Hopefully by now the readout system will be operational, and you will be ready to build the scanner. Dividing the project into two steps, in this way, should simplify the approach for most readers.

When the scanner was envisaged a number of performance requirements were set:

(1) Ability to scan in 25kHz steps.
(2) Cover the full 2MHz from 146MHz to 148MHz, the range over which the IC22S is guaranteed to operate.
(3) Ability to traverse the band very quickly so as not to miss short CQ calls.
(4) Stop upon encountering a signal, but scan on after a few seconds.
(5) Provision to prolong or override the stop mode in (4) above.
(6) Ability to stop and operate the transceiver on any of the 80 25kHz channels in the 2MHz it covers.
(7) Protection against transmitting while in the scan mode.
(8) Means to avoid stopping on the two spurious responses, 147.075MHz and 147.200MHz, which are inherent in the IC22S.
(9) Still allow normal operation of the set, using the 22 channel selector switch.
(10) Use cheap, readily available components, and consume a minimum of additional power.
(11) Require no alterations to the standard operation and performance of the set.

The final version of the scanner has achieved most of these aims, with few compromises, as a result of much experiment and some hard thinking. It scans in 25kHz steps and, in the fast mode, covers the entire 2MHZ from 146MHz to 148MHz in less than two seconds.

(In order to achieve this fast scan, the mute circuit had to be duplicated but with less delay than the mute in the receiver. This in no way affects the receiver operation, nor does it require any modifications to the radio; simply the addition of one wire to pick up the mute audio signal.)

The scanner will stop when it encounters a signal capable of opening the mute. Once the device has stopped on a channel it remains there for five seconds. (This can be adjusted by varying R_2 and C_2.) Then it begins to scan once again. This was found to be a good compromise. The operator can hear call signs and repeater "Ident" and have time to move the control switch into the "hold" mode if he so desires before it begins to scan again.

The system will immediately begin to scan again as soon as the signal disappears, ie, if the device stops on a signal and that signal is removed two seconds later the device begins to scan immediately. It will not wait the full five seconds before moving off, as this would be a pointless waste of scan-time.

A slow scan facility has been provided and this enables one to step the device to any desired frequency. This completely obviates any need for a programmer type device. The slow scan dwells for 0.5 second on each channel. This time was found to be adequate to enable stopping if and when desired on any channel.

Special circuitry prevents the scanner from stopping on the two spurious frequencies, so that signals on these channels will not be recognized either. This was found to be far preferable to turning the mute hard on to prevent the scanner from stopping on these frequencies every time around, which also prevents it stopping on weak signals. Normal operation on these frequencies is not inhibited, ie, they can still be manually selected and used.

Unless the control switch is in the "hold" mode the transmit circuit in the 22S is inhibited, preventing any transmission while scanning. This switch is overridden under normal transceiver operation, ie., when the scanner is switched off.

CMOS ICs have been used throughout and all are readily available, "garden variety", devices. As with the digital readout, any of the ICs for this project are "off-the-shelf" devices at Radio Despatch Service.

The only modifications to the IC22S

*17 Meadow Rd, New Lambton, NSW 2305.

are the addition of 21 wires soldered to various points as detailed in the photos. The scanner was mounted inside the unit, as this saves connections from the outside world, and it fits easily into the available space. The only external leads are to the "fast-slow-hold" switch which is mounted on the digital-readout box.

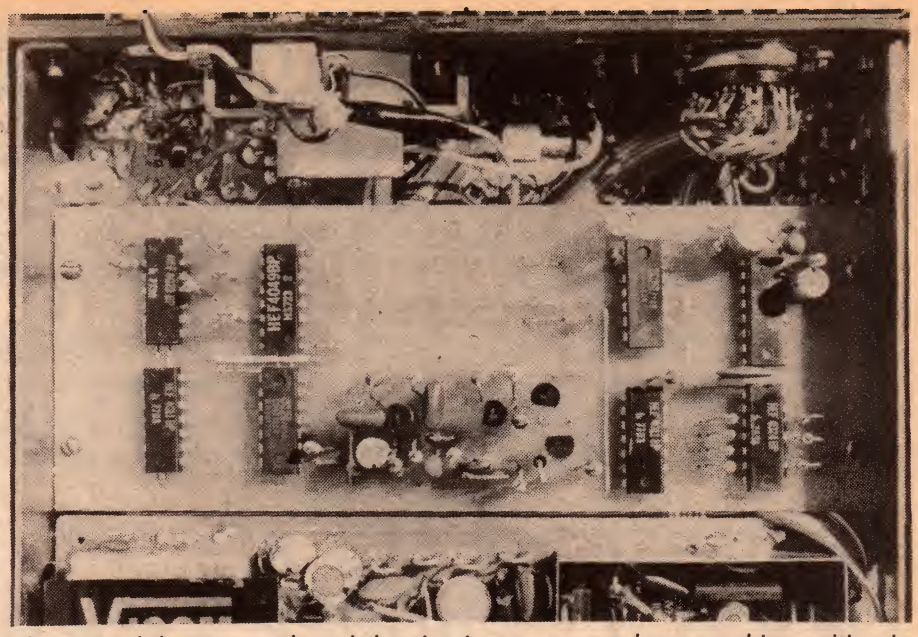
The operation of the scanner is best described by reference to the block diagram in Fig. 8. The interested reader may also refer to the circuit diagram Fig. 9 for greater detail.

Audio from the transceiver is tapped off before the volume control and fed to point A. Transistor Q1 amplifies this signal which is then rectified by the OA95 Diode. Q2 and Q3 provide a DC amplifier so that when the mute opens Q3 is turned hard-on. Two gates of a 74C14 shape the signal which is fed to the B input of a 4528 monostable multivibrator. This signal is now in a form suitable to control the scanner.

What is needed to scan the band is a system of connecting all the diode combinations in sequence to the matrix board. This is achieved by connecting one end of a set of diodes to the matrix and the other end of the diodes to the outputs of a 7-stage binary counter (4024). When the outputs Q1 to Q7 go high the diodes are effectively in circuit and when low the diodes are out of circuit. Hence all frequencies can be achieved by incrementing the counter.

A 74C14 gate forms the clock oscillator, along with C1 and R1, which increments the 4024 counter. As the clock pulses are generated the frequency is incremented in 25kHz steps until 148MHz is reached, whereupon the reset circuitry returns the system to 146MHz where it starts counting again.

The clock pulses from the 74C14 are controlled or gated on their way to the 4024 counter so that, by stopping the pulses, the counter is stopped on a particular frequency. Four gating circuits are provided to inhibit these pulses.



Close-up of the scanner board showing its component layout and its position in the set. The set's 9-pin socket is at top right and the speaker socket, with modified wiring, at top left. The set's synthesizer board is at the bottom.

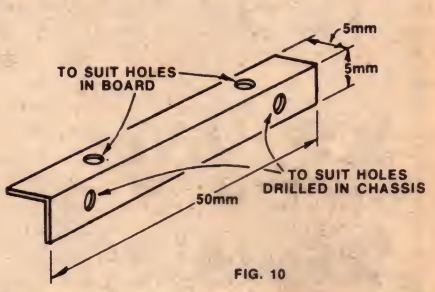


FIG. 10

The scanner board is supported inside the set on two small aluminium brackets made to the dimensions shown.

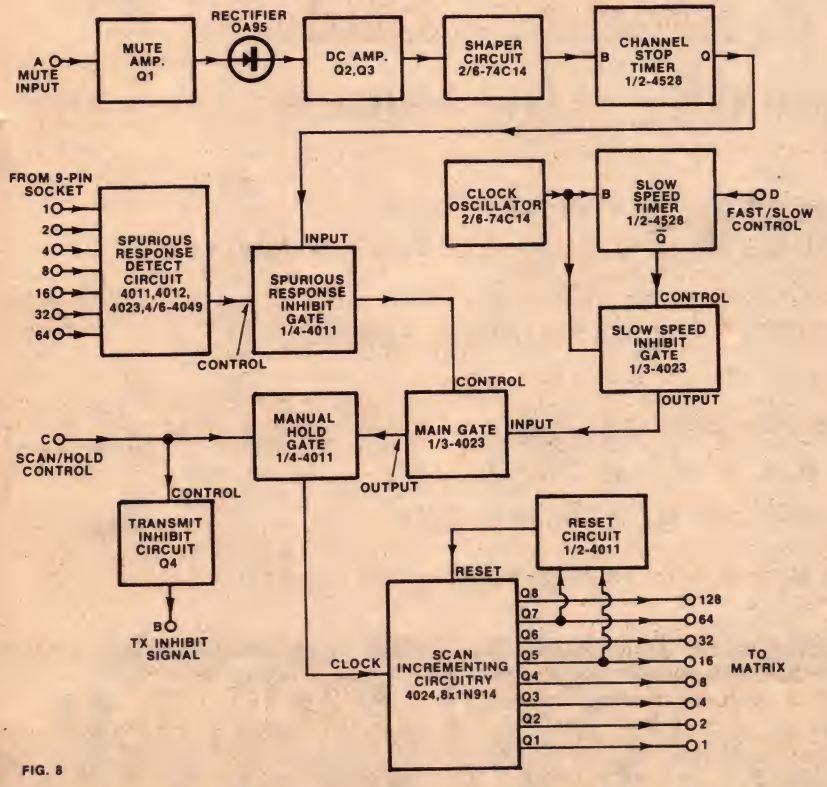


FIG. 8

Fig. 8. This block diagram should give the reader a good idea of the various sections of the scanner, and their function. The specific form of each section is shown in greater detail in the circuit diagram on the next page.

One gate is controlled manually, by the "hold" switch, so that the device can be stopped at will. A further gate inhibits clock pulses to produce the slow scan mode. Another gate is controlled by the mute signal which inhibits pulses when the mute opens, ie, when a signal is encountered the device stops on that channel. There is also a special spurious response gate which inhibits the counter from stopping on the spurious signals in the IC22S (147.075MHz and 147.200MHz).

The "hold" switch also controls a transmit inhibit circuit. This prevents transmission while in the fast or slow scan modes, as a safety precaution.

When it is desired to use the radio in a conventional manner, ie, use the ordinary 22 selectable channels, it is simply a matter of turning the channel knob to the required channel. The scanner is turned off and completely overridden on any channel except the one to which it is connected. In my case I connected the scanner to the 23rd position on the diode matrix. This corresponds to one of the two dots on the two blank positions, but the constructor can put it on any channel he desires.

The scanner is built on a single-sided board 54mm x 143mm. All components

except the switch are mounted on the board. Construction should be quite straightforward if the component overlay is followed. Observe capacitor polarities and IC orientation. (The 4049 is reversed with respect to the other seven ICs.)

The four transistors should preferably be plastic types, as metal cans may touch. There are 20 links and these should be put on first. NOTE: One link running between the 4049 and the 4012, needs to be insulated as it crosses two others running under those chips.

There are 21 connections to be made to this board. A group of eight run from the diodes associated with the 4024 to their respective locations on Ch 23 of the diode matrix board. Connect them to the points where the diode cathodes would normally go and leave the anode holes vacant. Rainbow cable makes this job easy. While dealing with the matrix a lead from switch position 23 needs to be run back to the +9V on the scanner board. This then supplies power to the scanner only in that switch position.

Seven leads need to be run from the 9-pin socket on the back (where the leads go out to the digital readout) to the seven 150k resistors associated with the 4023 and 4012 (spurious response detect circuit) on the scanner board. The lead from 64 (ie, from pin 7 of IC1) which was left floating and unused by the digital readout, is connected to the corresponding lead from the scanner. The other six leads solder onto pins 1 to 6 of the socket.

Three leads need to be connected to the main IC22S board. One is from the ground connection of the scanner board to the same point on the main board. The second is from point "A" on the scanner board to the junction of Q14 collector, L12, and C61 on the IC22S main board. The third is from point "B" on the scanner board to the junction of Q33 collector, Q32 base, R143, and D22. The terminations of leads "A" and "B" on the main board are marked on the photograph.

Leads from points C and D on the scanner go to pins 8 and 9 on the 9-pin socket. (These pins should have been unused until now.) The 9-pin plug is wired correspondingly, its leads going to the switch inside the readout. The common of the switch is wired to chassis inside the readout. The schematic in Fig. 11 should make this wiring clear.

The scanner board is mounted behind the synthesizer board in the transceiver, with a 2mm gap between

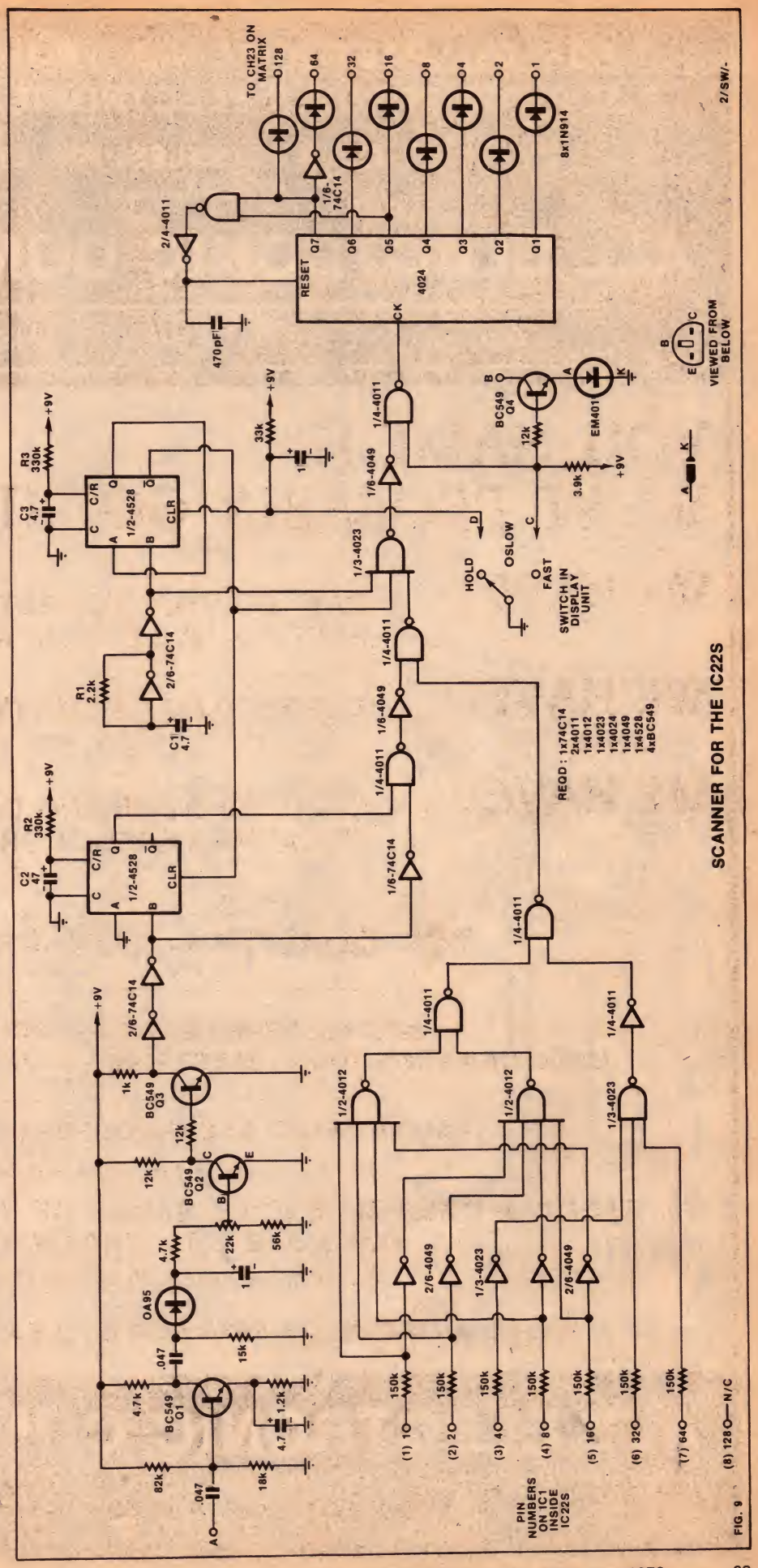
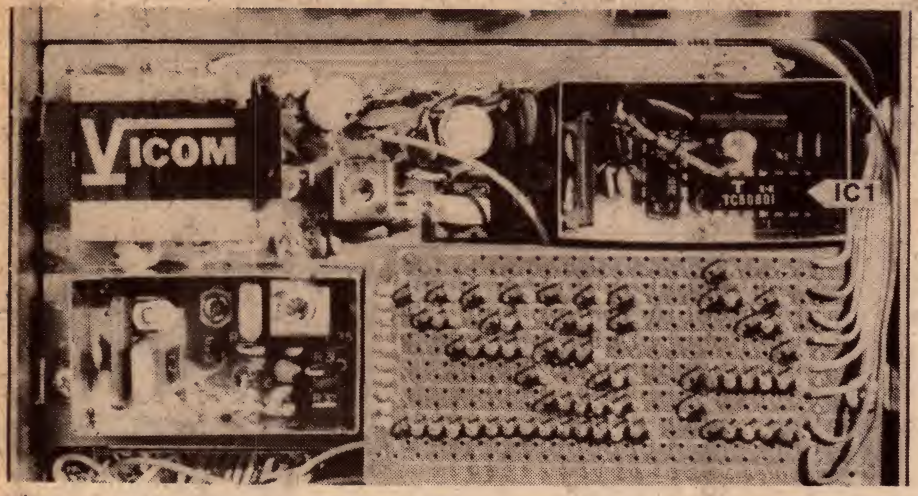
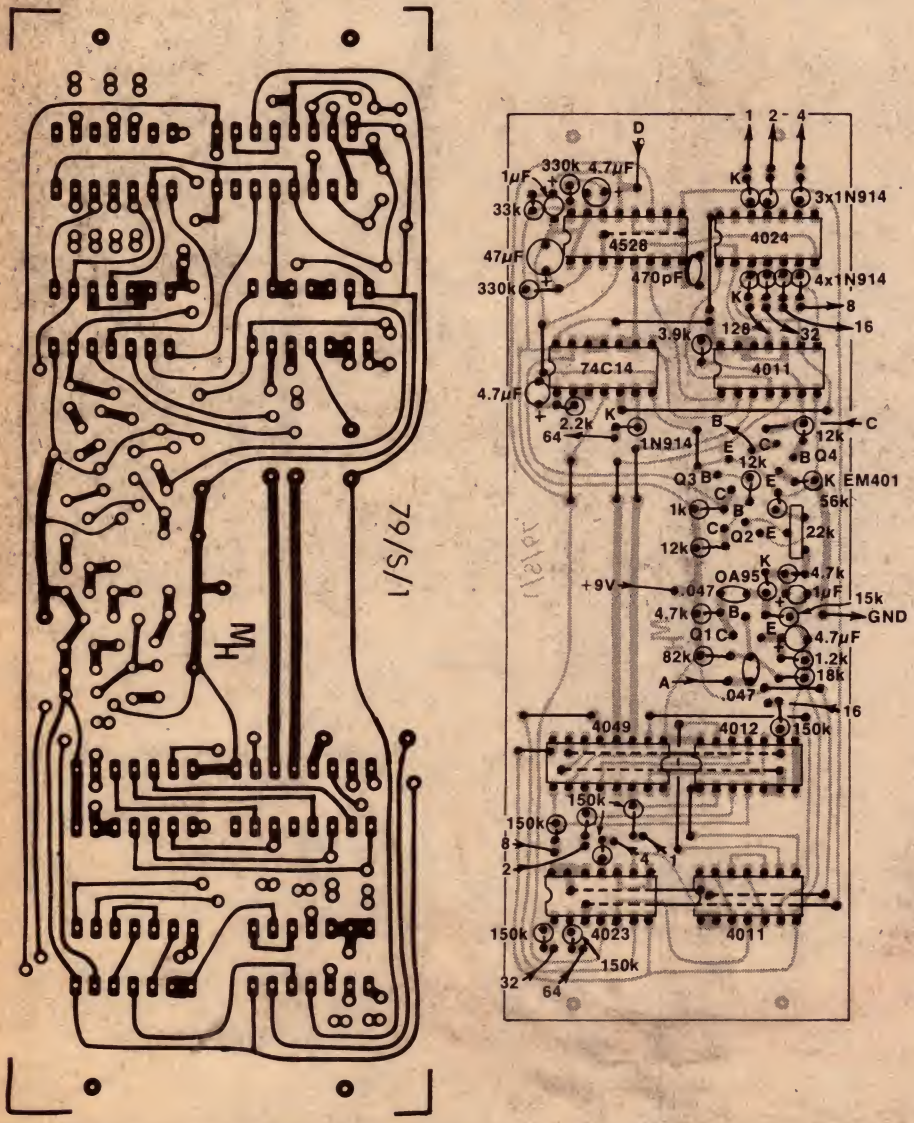


Fig. 9. The general concept of the scanner, shown in Fig. 8, is shown in greater detail in this circuit. The main connections to the set are shown.

ICOM 22S SCANNER



This picture shows the front section of the set, including the synthesizer board, the matrix board, and the lower edge of the scanner board at the top of the picture. The ICOM IC1, TC5080P, is indicated in the shielded enclosure at top right.



The diagram on the left is of the printed board, actual size, as seen from the copper side. On the right is shown the component positions, from the component side, superimposed on the copper pattern. Note IC orientation carefully.

PARTS LIST

SEMICONDUCTORS
- *2 4011 Quad 2 input gates.*
- *1 4023 Triple 3 input gate.*
- *1 4012 Dual 4 input gate.*
- *1 4049 Hex buffer inverter.*
- *1 74C14 (40106) Hex Schmitt Trigger.*
- *1 4528 Dual monostable.*
- *1 4024 7 stage ripple counter.*
- *4 BC109, BC549, etc. (Plastic preferable)*
- *8 1N914 or diodes supplied with IC22s matrix.*
- *1 OA95 Germanium diode or similar.*
- *1 EM401 Silicon rectifier or similar.*

CAPACITORS
- *1 470 pf Ceramic disk*
- *2 0.047uF Polyester or plastic film.*
- *3 4.7uF 10VW Electrolytic single ended.*
- *1 47uF 10VW Electrolytic single ended.*
- *2 1uF 35VW Tag tantalum.*

RESISTORS
(All resistors miniature ¼Watt unless otherwise specified.)

1 1k	
1 1.2k	*1 x 18k*
1 2.2k	*1 x 33k*
1 3.9k	*1 x 56k*
2 4.7k	*1 x 82k*
3 12k	*7 x 150k*
1 15k	*2 x 330k*

1 22k Skeleton preset pot (miniature)

MISCELLANEOUS
- *1 Single pole, 3 position switch.*
- *2 L-shaped mounting brackets. (See text.)*
- *1 Scanner printed board. (79/S/1)*
- *4 Self tapping screws for bracket.*
- *4 Self tapping screws for PC board.*
- *Rainbow cable and hook-up wire.*
- *Solder.*

them, and at the same level as the synthesizer board. It should not be mounted any lower, as it will be too close to the main board, and it should not be any higher as it may foul the speaker. In any case, it would be wise to put some insulating tape on the dome of the speaker, in case it touches the links on the board. (If you intend to mount it any lower a shield similar to the one used on the synthesizer board is recommended.)

Two angle brackets support the scanner board at either side of the case. They were fashioned from 22 gauge steel and Fig. 10 shows their construction. Self-tapping screws hold the bracket and the PC board. The photos give a good idea of what has to be done.

Having completed construction check all wiring carefully. If it is correct the scanner should be ready to turn on. The preset pot needs to be adjusted to make the scanner of equivalent sensitivity to the transceiver mute.

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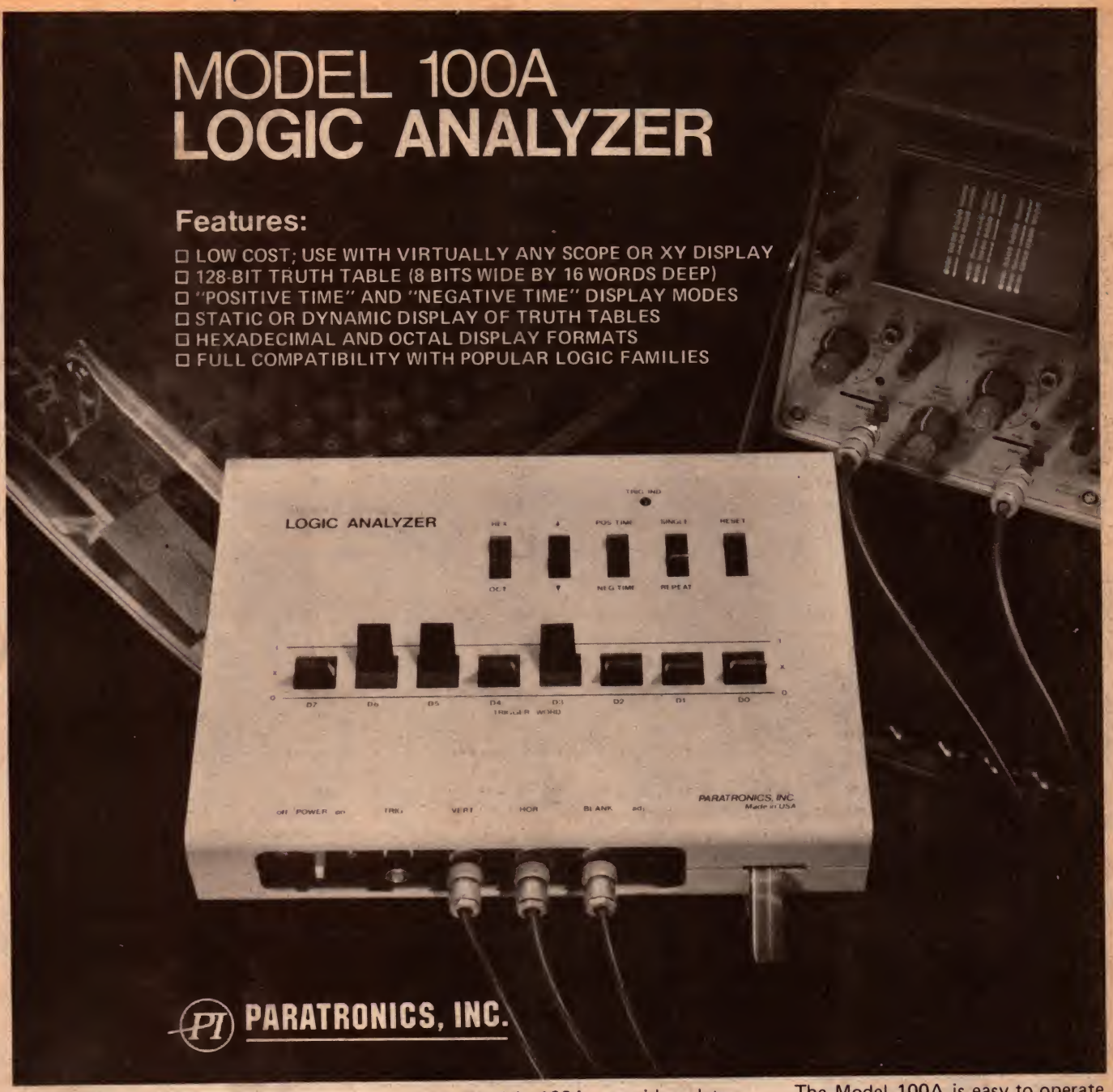

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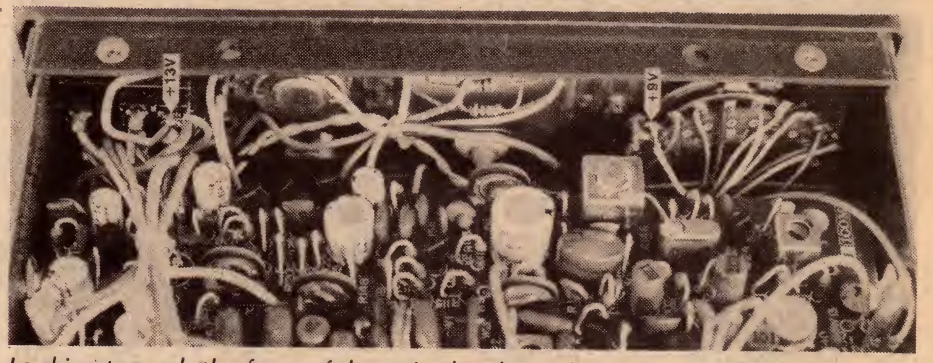
If it is too sensitive the scanner will stop on signals which do not open the mute. If it is not sensitive enough it may not stop on weak signals.

To set this pot correctly proceed as follows. Connect the digital readout and turn the rig on. Remove the aerial lead and turn the present pot fully anticlockwise (ie. mute fully open). Now set the scanner switch to fast scan. The readout should now increment quickly and unimpeded.

Advance the panel mute control until it is almost closed, ie, just barely "chattering". Ignore the "crash" that occurs when the device resets from 148 to 146MHz. Advance the preset pot on the scanner board slowly, while watching the digital readout. Keep advancing it until the display begins to falter and momentarily stop on random channels. This is the most sensitive setting, but suffers from the disadvantage that it produces a crashing sound each time the PLL goes out of lock on resetting.

For normal operation the mute control can be advanced somewhat from this threshold position. With a small advance the crashing sound will disappear and the device will scan silently. At this setting a signal which barely moves the S meter will stop the scanner. Even with the mute hard-on, an S1 signal will still stop the scanner. The individual can ex-

Shown here is the underside of the synthesizer board showing the eight leads from the IC1 (IC5080P). The leads "A" and "B" from the scanner board are also indicated. The scanner board shown is an earlier version.



Looking towards the front of the unit, the channel selector switch is on the right, with position 23 marked (+9V) The power switch is on the left with the extra lead from it also marked (+13V).

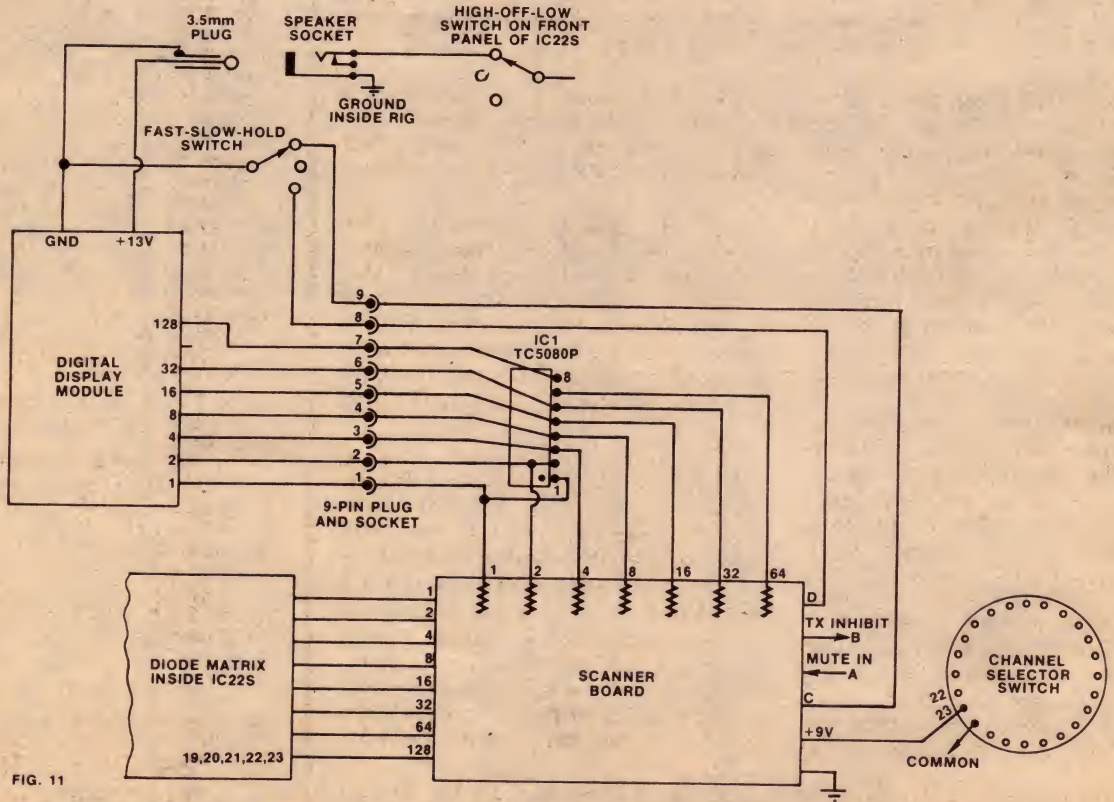


Fig. 11. Getting it all together! This interconnection diagram should help the constructor to follow the connections between the various units and sections. Cross check it against the photographs and main circuit diagram.

ICOM 22S SCANNER

periment with the control, for personal preference, but it must be emphasised that if it is not accurately set, the device will not perform as well as it should.

The fact that the scanner has but a single control switch on the front panel may suggest limited facilities. But this is not the case. This single pole, 3-position toggle switch performs the equivalent function of two double throw switches and a pushbutton switch.

Consider such a system with a "scan-hold" switch, a "fast-slow" switch, and an "override" pushbutton (to force the device to scan on before the five seconds has expired). The single switch achieves all this as follows —

In the upper position it will "fast-scan", stopping for five seconds on encountering a signal. In the middle position it will "slow-scan" and will stop for 0.5 seconds on every channel, regardless of whether there is a signal on it or not. In the lower position the switch will cause the scanner to "hold" or stop on a channel.

If the system is fast-scanning and the operator wishes to override a five second stop he should move the switch from "fast" to "slow" and back again fairly quickly. This will reset the timer and the device will immediately "scan-on". If, alternatively he wishes to stop the device indefinitely on that channel he should move the switch from "fast" through "slow" to "hold". NOTE: With either of the above operations if the switch is left in the slow position for more than 0.5 seconds the scanner will begin to increment channels at the slow rate.

No amount of explanation can give the user a "hands-on" feel for the switch operation, but it requires only a few minutes practical use under typical conditions for him to become completely familiar with its operation. While the written explanation may sound complex, it is really quite easy to use in practice.

Perhaps this is a good time to mention a few limitations of the system. Firstly repeater operation needs a little practice because, unlike more conventional rigs, the IC22S moves either the transmit or receive up 600kHz, not the transmit up or down 600kHz. Hence, to work a repeater when the scanner is being used the offset must be on before it stops on the repeater output frequency.

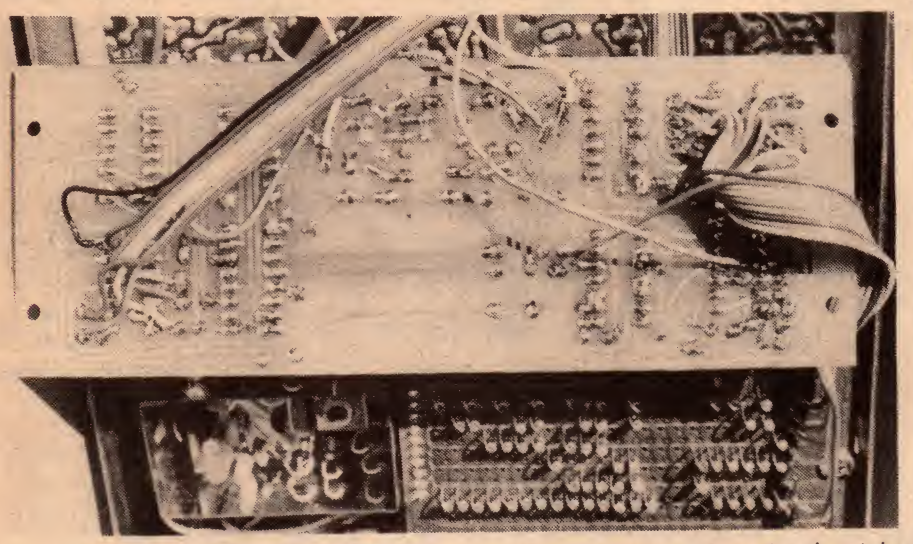
Also, the mute characteristics change with temperature. This results in a tracking problem between the transceiver mute and the scanner mute gains. In practice this is not a real problem if the mute is not set too finely.

The only other hassle is the one already mentioned; the noise created when the system jumps back from 148MHz to 146MHz, causing the PLL to momentarily go out of lock. This is more annoying than anything else and, as already explained, may be overcome by setting the mute a little harder on than usual.

(Editorial note: As this article went to press the author had indicated that he was working on a modification to the system, aimed at eliminating this noise burst. Should the modification prove successful, we will probably cover it in a later issue.)

Even considering these minor limitations, the system performs exceptionally well considering its simplicity. So that's about all there is to putting a digital readout and scanner on your IC22S.

One last comment might be in order here. If we all just scan the band and don't call, then nobody will know that anyone else is listening!



The scanner board turned over from its normal mounting position. On the right can be seen the rainbow cable running to the matrix board. Portion of the scanner board brackets are just visible at the top of the picture.

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Modification lets PIPBUG work at 300baud

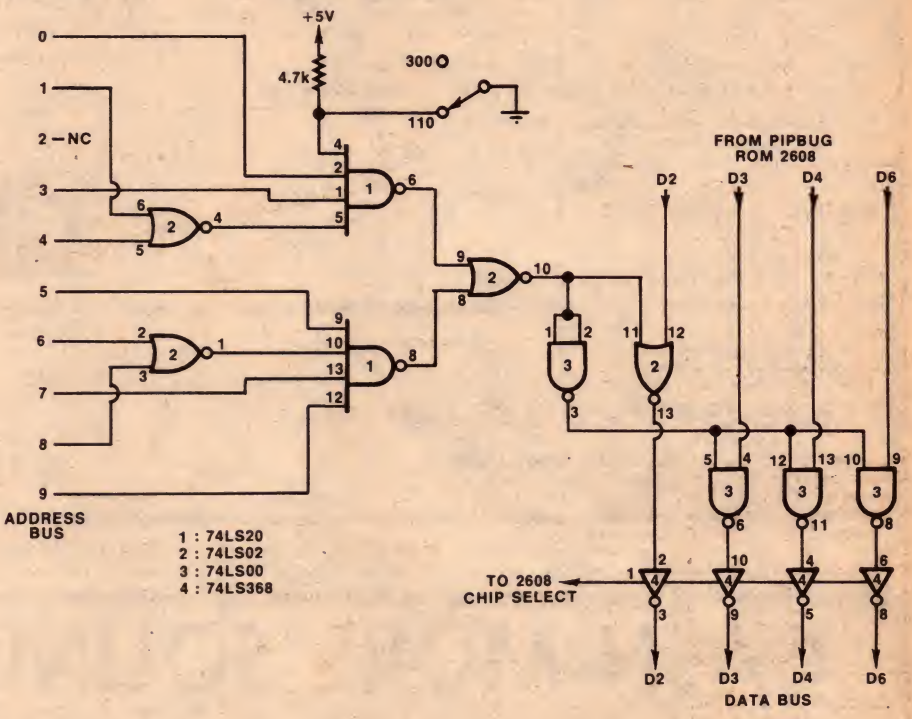
The following are details of a hardware modification to the PIPBUG monitor program for the Signetics 2650. This modification allows the program to run at either 110 baud or 300 baud. Programs can be entered at 100 baud and run at 300 baud, and vice versa.

Standard TTL was used in a 2650 Mini Computer as described in May 1978, to which address and data buffering had been added. It should be possible to use LS TTL in an unbuffered version. The conventional approach in changing the delays is to reduce the number of loops and to change the number loaded into RO. However, I decided to attempt to modify the instructions. The modifications are as follows:

ADDR	B1	B2	300baud modification
02A8	20		
02A9	F8	7E	A4 7E (A4 — SUBI)
02AB	F8	7E	(88 — ADDR)
02AD	F8	7E	A4 7E
02AF	04	E5	
02B1	F8	7E	
02B3	17		

Note that "88" may be used instead of "A4".

I leave the reader to work out the fine details but the principle is as follows: The "A4" at 02A9 destroys one loop and loads RO with 00 — 7E, ie, 82. The "A4" at 02AD destroys the loop and makes a redundant instructions, as the next instruction (04E5) overrides it. If "88" is used instead of "A4", RO is loaded with "88".



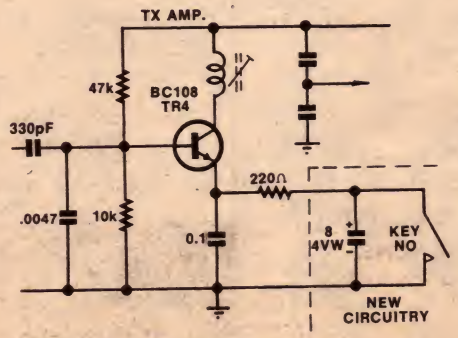
As you can see, only two instruction bytes have to be changed, and both need to become the same code. As these cannot be changed inside the PIPBUG ROM itself, the logic circuit shown is used to detect when either of the two addresses concerned is called by the processor. When this occurs it simply disables the relevant ROM data outputs, and presents the substitute code instead.

The design as shown uses four simple LS TTL gates. No board design is given. Pin connections are those used in my particular design. It should be noted that the data output lines from the 2608 ROM must be cut and that AD2 is not decoded.

(By Mr R. W. Brown, VK7ZRO, 215 Carella Street, Howrah, Tasmania 7018.)

Simple change allows CW operation on 3.5MHz Transverter

Here is a modification for amateurs who have built the 27/3.5MHz Transverter as described in April, 1976. It enables the operator to send CW (Morse code) with few changes in the transverter. The modifications are as shown in the diagram. Further modification may be either, (a) set the transceiver to AM mode and use an elastic band or similar to hold the microphone button down, (b) use PA/transceiver switch to lock transmitter on, (c) use DPDT switch on transverter to switch transceiver as well. The method to be adopted may vary according to the peculiarities of each individual arrangement.

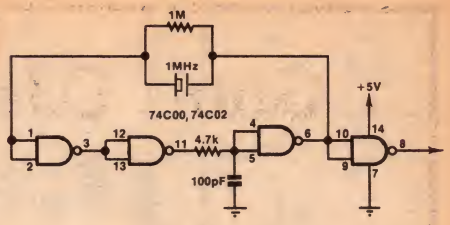


According to the power output of the transceiver, it just may be necessary to change the two 100 ohm terminating resistors to cope with a higher rating. It should also be noted that for normal phone use, the CW key must be locked down.

To receive CW, switch the transceiver to LSB and adjust clarifier for a suitable beat note. I find no need for a sidetone oscillator, although one could be added if required. I have had many enjoyable CW QSOs with the above modifications.

(By Mr K. Madden, VK4AKM, 19 Allawah Street, Albany Creek, Qld 4035.)

Crystal oscillator suits 2650 Minicomputer



This is a simple crystal oscillator, suitable for use with microprocessor systems requiring a 1MHz clock frequency. It can be used to replace the RC oscillator of the 2650 Minicomputer, and uses only a single CMOS IC. Either a 74C00 or a 74C02 can be pressed into service.

All of the gates are used as inverters, three as the oscillator proper, and one as a buffer. An RC delay circuit is included in the oscillator loop, to prevent oscillations at the third harmonic of the crystal. The 1M resistor biases the loop into the linear region.

There are no special requirements for the crystal. Output drive capability is two low power TTL loads. Refer to the 74C series data sheets for more information on this point

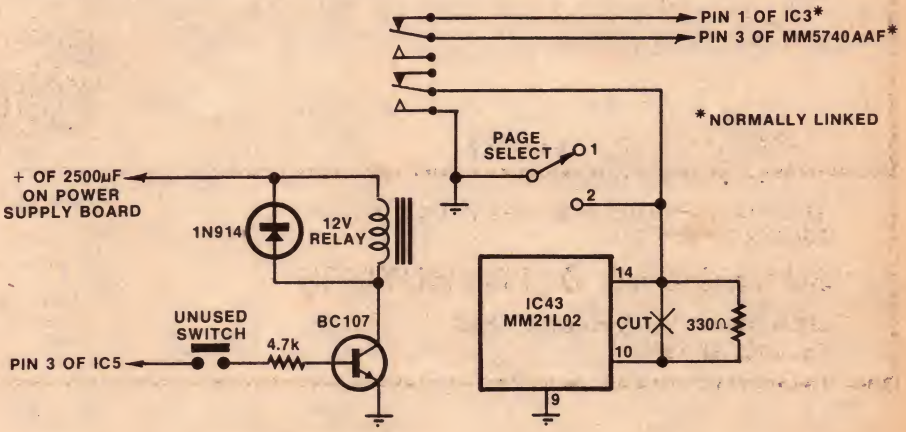
(by David Edwards, Electronics Australia staff).

Non-destructive backspace, space and line feed for VDU

Simple modifications to the VDU described in February and March 1978 add the facility to specifically alter any character on any line of the display while in the typewriter mode. Only 512 of an available 1024 display locations are used in the original design.

The "extra page" can be displayed by cutting the track, on the upper side of the board, betweeen pins 10 and 14 of IC43, soldering a 330 ohm resistor across the cut and shorting pin 14 of IC 43 to earth with a toggle switch. When text is entered on this second page, only the position of the cursor is altered on page 1. Thus one can select page 2, position the cursor in the equivalent position of page 1 which requires alteration, select page 1 and perform the alteration. In particular, 15 line feeds when in this mode, are equivalent to a reverse line feed. A further line feed restores the display to its original (apparent wrap around of the 16 lines occurs).

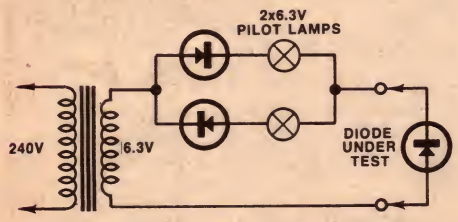
These operations are combined to provide a single-key facility by using the low frequency clock output of IC5 to operate a double pole relay via an unused keyboard switch. One set of contacts alternately selects pages 1 and



2, while the other set disables the keyboard encoder whenever page 1 is selected. If the contents of page 2 are cleared, depressing the switch causes the display to flash and the cursor can be moved normally to the location required without altering page 1.

Layout is not critical. The relay may be attached to the case in any convenient position and the transistor and diode may be soldered directly to it. (By Mr D. W. Johnson, 2/13a Aberfeldy Avenue, Edwardstown, SA 5039.)

Try this simple diode tester



In this very simple diode tester, if one lamp lights the diode is OK. If no lamp lights the diode is open circuited. If both lamps light the diode is short circuited.

(From "Dragnet".)

Editorial note: The idea seems to be a good one. However, care should be taken with small signal diodes to ensure that ratings are not exceeded, with the possible demise of the diode. An improvement which comes to mind is to replace both of the circuit lamps and diodes with two LEDs and suitable current limiting resistors. This should avoid any danger to small diodes under test.

The Serviceman

When the data sheets are wrong — try mathematics

I have two stories this month, both from fellow servicemen. I make no apology for this, since both are more interesting than the rather routine jobs which have come my way lately. One emphasises the tricky nature of direct coupled circuits, and the other describes a problem caused by incorrect manufacturer's data.

These items come from various sources; readers' letters, brief snippets from colleagues, and even comments in overseas magazines. So long as they touch on the servicing scene, I feel that they are worth passing on.

My first story comes from a reader — and fellow serviceman — who confesses to having read these notes regularly for the past 22 years! Such dedication is surely deserving of some reward; even if it is only the satisfaction of seeing one's own story in print. (This doesn't mean that any other reader who has been around this long will automatically qualify to have his story published!)

Anyway, to get on with the story. The contributor is Mr P. T., of Altona, Victoria, and he writes as follows:

I would like to tell you about a most unusual intermittent fault I encountered recently. It concerned a 12in portable monochrome TV set, HMV model 1184, which arrived with the complaint, ". . . the picture collapses to one inch high after a few hours".

Well, that sounded easy enough. Probably some component packing up when it became hot. But it wasn't as simple as that. After pulling the chassis out of the case I switched it on and let it run. Sure enough, after about 20 minutes the picture suddenly collapsed to about one inch high, as stated.

Referring to the circuit revealed that the vertical section used five transistors in all, and all direct coupled. There were two transistors in a Miller integrator/oscillator combination, a third as a driver, and two more in a complementary-symmetry type output stage driving the deflection coils.

DC measurements compared with the circuit showed that all was not well with any of the transistors, though some were further from the mark than others. Suspecting a faulty transistor, I changed each one in turn, only to draw a blank. But I learned one thing from the exercise; the periodicity of the fault could be anything from five minutes to four days!

Next I tried freezing each component in the vertical section when the fault occurred, but again drew a blank. The fault remained even with the whole of the vertical section covered in frost from the instant freeze spray.

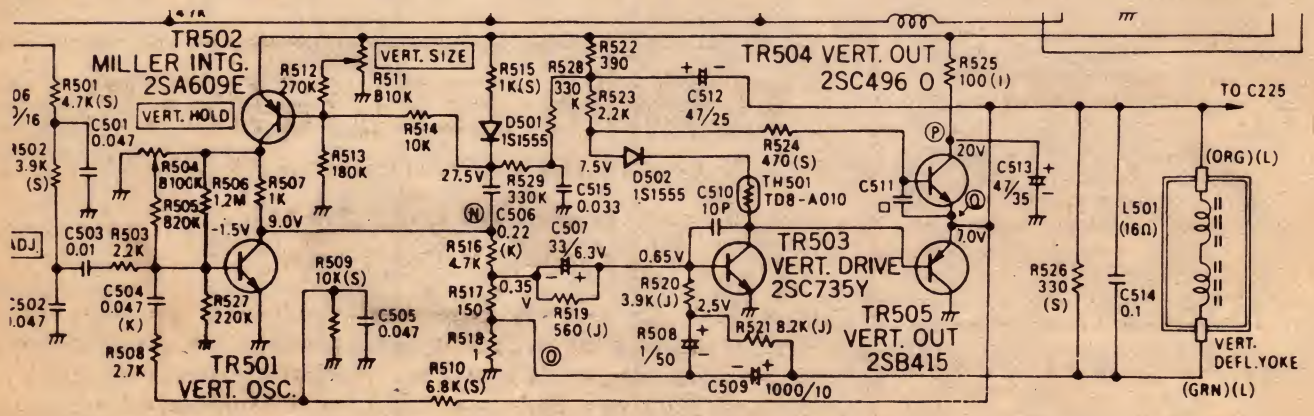
Another unusual aspect of the fault was that it would just correct itself and then run merrily for hours without recurring. Nothing could persuade the fault to re-appear until it was ready. I tried cooking the board, flexing it, thumping it — you name it, I did it, but all to no avail.

Subsequent testing eliminated the yoke, the diodes, and the thermistor. I then tried a trick I have used with much success with direct coupled audio amplifiers under similar conditions. I use a 10k pot which I connect between the positve supply rail and chassis, with the moving arm going to an "Ezi-hook" via a 1k resistor. This can be clipped to the base of any transistor.

Making sure that the moving arm was at the earthy end of the pot I connected the hook to the base of the driver stage, TR503. Then, by advancing the arm of the pot it was possible to restore all the DC voltages around the output pair, suggesting that the fault was back towards the oscillator/integrator section, TR501/502. I repeated the procedure from the collector of TR501, with the same results.

Earlier DC voltage checks had indicated that the oscillator self-bias on TR501 was falling under fault conditions, but the cause was not clear; was it lack of feedback from the output stage caused by the change in DC potentials on all stages? Or was it the TR501 stage itself going faulty and not sending enough amplitude towards the output stage?

The test with the pot suggested the latter, so I began checking every com-



Relevant portion of the HMV 1184 circuit, showing the vertical oscillator and output stage. As well as being intermittent, the fault was made more difficult by reason of the direct coupling used throughout.

ponent around TR501/502, while the fault was in evidence. Nothing showed up until I measured the value of resistor R503. Supposedly a 2.2k, it read 3M — Ah, at last!

I removed the resistor from the board and measured it again. I read 2.2k! What was going on? I replaced it on the board and measured it again, getting a reading of 7M. Then it suddenly hit me; I had been making these measurements with the set running, which seemed permissible because the resistor was isolated, in the DC sense, by its associated capacitor, C503. But now I was convinced that DC was flowing through the resistor and this upsetting the ohmmeter readings.

I removed the resistor again and then measured from C503 to chassis on the 1mA range. Sure enough, I found a current of 0.1mA, a sure indication that C503 was faulty. I replaced it, then checked it more closely. It was a.01uF greencap and I hooked it across the ohms range of a digital multimeter. It read infinity initially and no amount of heating or freezing would vary this reading, so I just left it connected.

After about half an hour it started — the meter went beserk. First 10M, then 7M, then 1M, then back to 10M. This went on for about half an hour, then it came good. It is the most unusual fault I have ever encountered, especially as the capacitor was not sensitive to temperature variations.

Well, I suppose you can't win 'em all — not straight away, anyhow.

Well, that's Mr P. T.'s story and I can only agree that it is a most unusual fault, considering the component involved and its behaviour. Also, I like the idea of the 10k pot for dealing with direct coupled circuits; it's a tip worth remembering.

Next comes a story from a New Zealand serviceman, Mr R. C., of Paraparaumu. (I'm glad I don't have to pronounce that!) He asks:

What should you do when a manufacturer gives incorrect data? Perhaps what I did and revert to that ancient stuff called math-ahem-matics.

It all began with a call to repair a Hammond Piper electronic organ. The symptom was no percussion. Inspection of the circuit showed that a direct-coupled amplifier applied amplification only to the percussion section. I checked the voltages and found them way out. Two replaced transistors later and all was well, with the percussion section percussing boldly. So was I two nights later, when I received a call saying the percussion had failed once more — only this time it was intermittent.

On my return I checked the voltages around the amplifier and decided that, since they were still wildly out, I would take the organ back to the shop to "soak" for a day or so.

Initially, it appeared to function only

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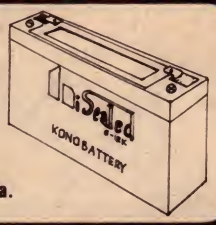

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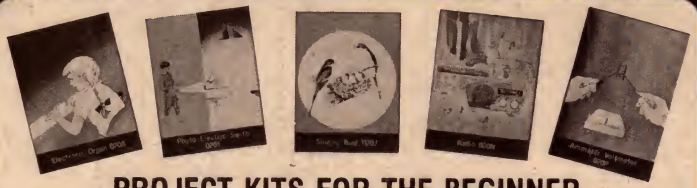

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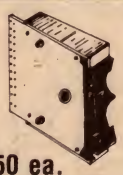

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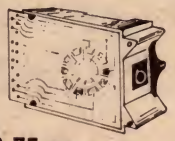

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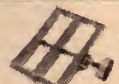

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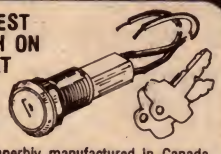

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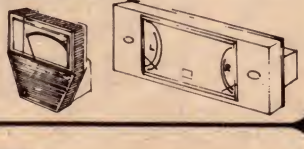

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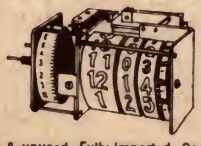

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after a warm-up period which accounted for its intermittent operation. When I finally did get to look closely into its malady the first thing I found was an open circuit 15 volt zener in the power supply. This caused 30 volts to be supplied to some of the circuitry, including the percussion amplifier.

With the new zener firmly in place I switched on and struck a chord. The Q-flat minor that reverberated off the walls sapped away my self-esteem. Distortion — piles of it — was pouring out of the speaker. This I traced to a corroded spring contact in a multi-way connector on the power amplifier board and it just happened to be in the 15 volt line. With this changed all was now working. Even the burble some black accompaniment keys were emitting was gone. (The owner had said nothing of this fault.) I switched off and left it overnight. That night I dreamed of melodious music accompanied by piano, sitar and harpsichord.

But the next morning I wished I had changed jobs. During the night my percussion had crept away and was probably hiding under a diode or the like. This time I returned to the little pre-amp, as I was now sure that all factors external to it were normal.

The manufacturer's circuit (reproduced herewith) gives various voltage values, and these I tried to duplicate, but to no avail. My first suspicions were aroused when I looked at the AC gain of 100 suggested by the manufacturer. (5mV in — 500mV out.) On the basis of R1 divided by R2 the maximum gain for stage one would be 4.5 and for stage two (R5/R6) about 3; a maximum overall gain of 13.5, not allowing for the feedback via R3.

Equally confusing were the manufacturer's suggested voltages for V1 and V2. If the V2 value (0.4V) was to be believed then Ic was 120uA, but if the V1 value (1.8V) was correct, then Ic was closer to 800uA. Even allowing for a reasonable Q2 base current flowing through R1, it was hard to reconcile the two figures.

The voltages actually measured in the circuit were as follows:

V1 = 3V
V2 = 2.2V
V3 = 6.5V
V4 = 2.7V

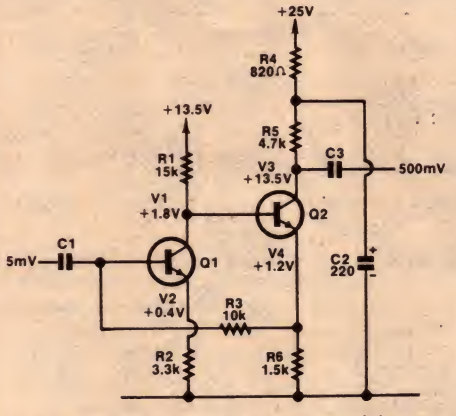
Was Q2 drawing too much current thus forcing the issue? Its collector voltage certainly indicated so. I checked Q2 and found it was up to its original specification, so back to the maths. A quick check proved that all resistors measured correctly. Now I looked more closely at V3 and V4. Two milliamps through 5.5k (4.7k plus 820 ohms) should have produced an 11 volt drop. It showed 18.5 volts! It was the voltage drop across R5 and R4 that highlighted the problem.

R4 = 8.5V
R5 = 10V

From these figures I calculated that 2mA was flowing through R5 but 10 milliamps were flowing through R4. C2 provided the answer to that riddle. It was busily sinking 8mA all by its clever little self. With that replaced V3 rose to 13.6 volts and all voltages then adjusted to:

V1 = 3.4V
V2 = 2.3V
V3 = 13.6V
V4 = 2.9V

Now Q1 was drawing 0.7mA and Q2 two milliamps with the circuit stable and with an AC gain of 10 — about what one would expect. But what about those voltages? Only by changing resistor values (eg R2 to 390 ohms)



Circuit of the percussion amplifier as taken from the manual, showing the voltage and gain figures which were suspect. The input and output signal voltages imply a gain of 100, which was unlikely, while the V1 and V2 voltages (Q1) are incompatible, in that they imply quite different collector currents.

would the voltages reach the values given but, as I am not one to redesign manufacturers' circuits, I decided it was best left functioning the way it was. It has been three months now . . .

One last word on the gain. The measured input signal was 75mV and the output 750mV. As well as confirming the calculated gain figure, it suggests that the 5mV shown on the circuit was intended to be 50mV; which would at least explain that anomaly.

Mathematics or intuition, whichever you use it certainly pays to have it honed and ready. You just never know when . .

Well, that's Mr R. C.'s story and, while I may not be as adept at pushing figures around the slate as he is, I have always believed that ordinary everyday ohms law-type maths can play a vital part in servicing. This is particularly so where the manufacturer's data is not available or, as in this case, suspect.

So keep those calculator batteries in good nick.

Classical Recordings

Reviewed by Julian Russell

Cilia — Adrienne Lecouvreur: "a set you shouldn't miss"

CILIA — Adrienne Lecouvreur. Complete Opera. Renata Scotto (Adrienne); Placido Domingo (Miaurizio); Sherrill Milnes (Michonnet); Elena Obraztsova (Princess of Bouillon); Giancarlo Luccardi (Prince of Bouillon) and others with the Philharmonia Orchestra and the Ambrosian Opera Chorus conducted by James Levine. CBS Stereo 79310. (Three discs with libretto in English, French, German and Italian.)

My relationship to this opera has been a strange one. As a small boy back in the first decade of this century I found a libretto of it at home in London in an old box-type piano stool. My parents must have attended an early performance of it at Covent Garden though, as far as I can recall, they never mentioned the work in my hearing.

At that time the only opera I had heard was Aida — not a bad start — when my father took me as a birthday treat. I read the libretto of Adrienne and woundered what sort of music it would be set to. I even tried to write some myself and did about six or seven bars. I came across them later. They were awful. Since then, despite its fairly frequent revivals, I had never heard a note of it until this set arrived for review.

I knew that to be cast in its title role was the ambition of the greatest sopranos of their day. Apart from that nothing. It still remains in the repertoire of Italian operas, is fairly often presented in Italy and occasionally at Covent Garden and the Met.

So it was with more than usual curiosity that I put the first side on my turntable. Its story tells in true operatic style of the usual tragic love affair. By the way, Adrienne Lecouvreur actually lived, was one of the greatest actresses of her period, had countless love affairs including a very serious one with, of all people, Voltaire, and the story sticks, as nearly as is possible in opera, to the facts of her life.

I was immediately enchanted by the first act with its backstage bustle and occasional soaring melody rather in the style of Puccini during his Manon Lescaut period. But as much as there was to be praised in the singing my special delight was in the orchestration, always original and sensitive, the harmonies sometimes unexpectedly subtle. By this I do not intend to disparage Puccini's scoring which also has its own particular merits, but Cilia's was entirely different.

In the first act there is a concerted vocal number that speeds along at a terrific pace not unlike the smugglers' quintet in the second act of Carmen. And there is a theme associated with Adrienne that will hang about in your head for hours after you've heard it. But during the second and third acts my interest started to wane ever so little. This was not because of the lack of drama in the action — there's plenty of that — but because the drama seemed to be confined mostly to the stage and the vocal parts and was not forcibly enough expressed in the exquisite scoring. The wooing tunes continued in plenty but the general format was too much like so many other Italian operas of the period — Cilia outlived Puccini by 26 years — that its novelty started to wear off.

But I must again try to impress that despite my continued mentioning of Puccini, Cilia made no effort to copy that composer who at that time was enjoying huge success with his works. However, I must point out that Puccini's orchestra was never at a loss to express all the drama that was going on on the stage and his sense of the theatre was outstanding. And that is my explanation of why Puccini's operas continue their attraction for present day audiences and Cilia's are starting to fade.

But whatever the reason Cilia's work remains an elegant example of that school. Everything about it is highly civilised, the work of a most ingenious and sometimes inspired composer, but its effect is rather like meeting a close relative several times a year. Mostly it's intensely pleasurable but hardly ever blood-stirringly exciting.

Dominating the cast is Renata Scotto in the title role. Her performance taken vocally alone conveys to perfection her changing mood of love and jealousy and her hopeless despair in the last act when she thinks her love has deserted her, turning to joy when she buries her face in the poisoned bouquet which her rival has sent her to make her think she has been reconciled with her lover. In her role as an actress she also has to declaim in speech some lines from the Racine play she is appearing in with the same fine effect.

The rival, Elena Obraztsova, gives you as unpleasant a woman character ever provided for a female "villain". The viciousness she projects both in her singing and vocal acting is quite astonishing. Both she and Scotto tend at times to harden a little on top fortissimo notes. The rest of the cast is on the whole excellent with special mention of Placido Domingo and Sherrill Milnes. All work together in perfect harmony (no pun intended) under the baton of James Levine who makes sure the balance between voices and orchestra is such that Cilia's wonderfully transparent scoring is always audible but never intrusive. The Philharmonia (no longer the New Philharmonia?) is in top form, evidenced by their obvious pleasure in their work. If you are a lover of Italian opera this is a set you shouldn't miss.

☆ ☆ ☆

BEETHOVEN — The Five Piano Concertos. Arthur Rubinstein (piano) and the London Philharmonic Orchestra conducted by Daniel Barenboim. RCA Stereo CRLS-1415. (Five boxed discs with a most comprehensive brochure included.)

Arthur Rubinstein must have been just on 90 years old when he recorded this new set of the Beethoven Concertos with young Barenboim. Issued separately from time to time, they are now offered in a handsome box together with an interesting brochure.

It would not be reasonable to expect an artist to perform with the same freshness and accuracy at such an age as he previously did during a long and distinguished career. (All right, I know Titian did.) But his playing in this new set is still that of a master albeit, not unexpectedly, with some blemishes that he would never have passed in earlier days. These consist for the most part of a slight lack of control of changes of sonorities and absence here and there

of the old time panache.

But he has retained his authority and his almost miraculous stamina. You soon realise that your are hearing some fine piano playing and that the player could be no one else but Rubinstein. I have never known a Chopin player of Rubinstein's genius who shone equally well in the works of Beethoven — or vice versa. These composers demand different temperaments from their executants and this fact must also be borne in mind when assessing the performances.

There are many, many passages when the old Rubinstein skill and freshness shines as it always did, and in the matter of interpretation there is always Barenboim to nudge him along the right path. Indeed I cannot remember when I heard better orchestral parts better played.

Technically, the piano usually sounds so far in front of the orchestra that, despite Barenboim's superb accompaniments, the piano sometimes momentarily disturbs the balance between soloist and orchestra, though on the whole the sound is fine. In the usual run of recording, blemished passages can be replayed and the correct version spliced in. This calls for an exhausting bar to bar series of repetitions until everyone is satisfied.

At a guess, this would have been just that too much to demand of the old gentleman who is now totally blind but, by all reports, retains his reputation of being one of the wittiest men in the world.

This is a most interesting issue. Barenboim's contribution is superb, and not to be missed because of the minor faults mentioned above.

☆ ☆ ☆

DEBUSSY — Orchestral excerpts from The Martyrdom of St Sebastian. Three Images for Orchestra. London Symphony Orchestra conducted by Pierre Monteux. Philips Universe Series Stereo 658-0266.

Little is heard of The Martyrdom of St Sebastian nowadays, and what there is, is mostly disparaging. It never has been really popular, even among Debussy's greatest admirers. In full, it is a mixture of stage and the incidental music Debussy provided. This is persuasive to some, even those who perhaps subconsciously distrust a religious subject treated by an avowed atheist.

This, of course, is absurd and I could quote many examples to prove it, among them the Faure Requiem, composed by the free-thinking organist at the Madaleine, one of Paris' greatest churches. And what about Wagner's Parsifal and, to some extent, Lohengrin? Or Beethoven's Masses?

For those without a complete knowledge of the score and Debussy's oblique approach to the drama, Le Martyr is no easier to follow than Pelleas and Melisande, a point picked out with a keen sense of perception by the writer of the sleeve notes, Derek Jole. Both have much the same air of spot on characterisation.

Debussy might have been an atheist but he was still artist enough to appreciate the beauty of the Christ legend. All the excerpts recorded on this disc are orchestral, a fact that doesn't help those unfamiliar with the complete work which consists of vocal and spoken sections and dance sequences. The pieces played here are the prelude to the first act: The Court of Lilies, Sebastian's dance on live coals, his Passion, and his vision of The Good Shepherd which occurs in the final scene.

The first has a strangely tonal atmosphere for late Debussy. The second, the Dance on the Burning Coals, shows no hysteria, no suggestion of the agony of burnt flesh — was there any? — though there is agony of the most exquisite kind in the Passion but which, by some miracle, never shows a hint of hopelessness. And how else could one describe a dying vision of Christ than by Debussy's music in the last excerpt?

Mostly, Debussy's approach to the work is nearly always oblique but he still manages to inject into it an occasional radiance that grows on the listener with acquaintance.

The Three Images for orchestra take up most of the disc. The first, Gigues, is based on the popular north-of-England tune, The Keel Row, which, even if unknown to you by name, you will recognise if you are of British origin.

Great conductor of Debussy's music though he was, the late Pierre Monteux doesn't seem, to me, to quite capture the cheeky gaiety of the original, though he comes close to it. But this might be explained by the fact that though Monteux frequently visited England he retained the average Frenchman's view of that country as a grey, dour place. This, mind you, is only a guess and wide open to contradiction.

The second Image, Iberia, is regarded by many as Debussy's finest orchestral work. I shall never forget the effect the slow movement had on me when I heard it for the first time in the late 1920s on an old 78 conducted by, I think, Lenau. To say that I nearly swooned with ecstacy is no exaggeration. Monteux' playing of it is faultless. Rightly did Debussy entitle it Perfumes of the Night. The Morning of a Festival is exactly what the title suggests: bustle, happiness, and a springlike freshness that captures one completely with its melodious buoyancy.

By the way, throughout the whole suite Debussy never uses one Spanish folk song or any tune resembling one. And I might add the curious fact that not one of the three most important composers to use Spain as a subject for their music — Tchaikovsky, Rimsky-Korsakov and Debussy — ever set foot in that country.

From memory, the original version was not notable for the quality of its engineering. In fact it was downright ordinary. The sound of the disc under review, played by the same artists as the original (many of whom have since died) is absolutely first class.

Rachmaninov: superbly played music

RACHMANINOV — Symphony No. 3 in A Minor. Der Fels (The Rock). Fantasie for Orchestra. Rotterdam Philharmonic Orchestra conducted by Edo de Waart. Philips Stereo Disc 9500 302.

While listening to this splendid orchestra, one is puzzled by the fact that it is used so little for recording purposes. It makes a grand sound, is perfectly disciplined, has excellent first desk soloists and an overall lustre that puts it right up among the world's best. At any rate that is how it sounds in the work under review.

Only in the first movement does de Waart seem to hesitate to bring the whole thing together — not technically but interpretatively. Elsewhere everything goes splendidly. The symphony belongs, of course, to the romantic school, but in it Rachmaninov has toned down some of the more luscious aspects of the more popular piano concertos.

Yet this symphony, too, has its soaring melodies, its many changes of rhythms and its scholarly formal construction. It is not a long work but its beautiful proportions give it true symphonic stature.

The fill is a "symphonic fantasie" — the composer's description of a work entitled Der Fels (The Rock). But since the sleeve notes are in untranslated German, and way beyond my elementary knowledge of that tongue, I cannot tell you anything about its program. But I can say it is typical Rachmaninov in form and content and no knowledge of a story is necessary to appreciate its many beauties. And this, too, is superbly played by the Rotterdam Orchestra.

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Lighter Side

Reviews of other recordings

Devotional Records

THE BILLY GRAHAM LOS ANGELES CRUSADE CHOIR. Directed by Cliff Barrows Stereo, RCA VAL1-0177.

With the next Australian Billy Graham crusade in the offing, it is not surprising that RCA has resurrected one of the many crusade albums in its possession. The one chosen — Los Angeles 1963 — features the 5000-voice choir assembled at the huge City Coliseum, rounding off with a total of 153,000 people singing "The Lord's Prayer". The album carries the original 1963 pictures of Billy Graham, Cliff Barrows, Bev Shea, Tedd Smith (piano) and Don Hustad (organ), just as many will remember them from that era.

Track titles include: He's Got The Whole World In His Hands — *He's The Christ Of Every Crisis —Wonderful Grace Of Jesus — To God Be The Glory — *I Would Be Like Jesus — Hallelujah Chorus — Onward Christian Soldiers — *Until Then — Glorious Is Thy Name — Brother James' Air — *How Great Thou Art — The Lord's Prayer. (*Featuring Bev Shea.)

It's a very typical crusade album, notable for the fact that the sound is completely "dry". In the open air, there is nothing to sustain and reflect even the sound of 5000 voices. Not surprisingly, however, with 135,000 performers, the last track scarcely needs it! (W.N.W.)

☆ ☆ ☆

PRAISE SONGS. Orchestra and Chorus conducted by Don Wyrtzen. Stereo, Singcord ZLP-3031-S. (From S. John Bacon Pty Ltd, 12-13 Windsor Ave, Mt Waverley, Vic 3149.)

The compositions, the arrangements and the supervision of orchestra and chorus are all credited to Don Wyrtzen, a young man prominent amongst today's Gospel musicians.

The title and a conservatively dressed Don Wyrtzen, featured on the jacket, give a prior hint that the album has been created for middle-of-the-road family Gospel listening. This proves to be the case, with a mixture of tracks ranging from gentle melody to modestly up-tempo. The titles:

Our Sacrifice Of Praise — I Found It — Unbounded Grace — Psalm Of My Life — Hallelujah, Yes Praise The Lord — Love Is Now — Yesterday, Today And Tomorrow — Celebrate — I'll Never Be The Same Again — Love Was When.

The performance is smooth and well disciplined and the quality of the imported pressing is excellent. Couple this with the content and you have an album that should find ready acceptance for family listening. Recommended. (W.N.W.)

Instrumental, Vocal and Humour

THE GREAT DISCO BOUZOUKI BAND. Astor Records Pty Ltd. Stereo FBSA071. Also on cassette (4BSAO71).

Greek music combined with a driving disco beat adds up to an enjoyable listening session on this rather unusual album. Featured are the traditional and infectious sounds of the Greek bouzouki and, with backing from guitar and percussion, the result is a record that you'll want to play "flat out".

According to the jacket notes, the Great Disco Bouzouki Band is based in Paris and its members come from families with a strong tradition in Greek music. The group first came to prominence with the single "Disco Bouzouki".

Here are the track titles: Giogio — Greek Magic (instrumental medley featuring Never On Sunday, Zorba The Greek, Pireas) — Ouzo & Retsina — Disco Bouzouki — Greek Girls — Do Re Mi Fa Soul.

Recording quality of the review album was impressive, with good stereo definition and negligible surface noise. Guaranteed to get the feet tapping. (G.S.)

☆ ☆ ☆

ANDRE PREVIN IN CONCERT With The London Symphony Orchestra. Stereo, World Record Club WRC 04979.

Here is an excellent classical sampler with music from eight composers, ranging from Albinoni through Beethoven to Walton.

The titles are: Prometheous Overture (Beethoven) — Adagio in G minor (Albinoni) — Marche Slave (Tchaikovsky) — Jupiter, from The Planets (Holst) — Fantasia On Greensleeves (Vaughn Williams) — Roumanian Rhapsody (Enescu) — Romeo & Juliet Ballet (Prokofiev) — Portsmouth Point Overture (Walton).

The overall quality is good, except for a little surface noise intruding in the quieter passages. The sleeve notes give a short note on each composer and the work recorded and the disc would make an excellent gift for someone starting a classical collection. (N.J.M.)

☆ ☆ ☆

GRAND GALA WALTZES. Benedict Silberman and his Orchestra. Stereo, Fable (Astor) FBAB-5322. Also available on cassette.

The 45-piece orchestra of Benedict Silberman sets out, on this album, to recreate the lush, fashionable atmosphere of a traditional ballroom. A chorus and instrumental solos serve to add variety but the sound never strays far from the traditional formula for the 12 waltzes:

Belle Of The Ball — The Perfumed Waltz — La Petite Waltz — Lovers Of Paris — After The Ball — El Patito — Grand Gala Valses — Monte Carlo Melody — The Chipmunk Song — Silhouettes In The Sand — Lover — Cocktails On The Champs.

The program will have its inevitable appeal but don't expect scintillating quality. The recording has a dated sound, with even the best tracks no more than medium-fi. (W.N.W.)

☆ ☆ ☆

CLARINET JAZZ GIANTS. Astor Golden Hour series GH-649. Also available on cassette.

If you're partial to jazz, in particular jazz featuring the clarinet, this "Golden Hour" album from Astor will give you your money's worth. Featured on the eighteen tracks are Acker Bilk, Sandy Brown, Tony Coe, Wally Fawkes, Terry Lightfoot, Archie Semple and Monty Sunshine.

Eighteen tracks would take a lot of listing but here's a 50% sampling: Boodle Am Shake — Satin Doll — That Old

Reviews in this section are by Neville Williams (W.N.W.), Jamieson Rowe (J.R.), Leo Simpson (L.D.S.), Norman Marks (N.J.M.), David Edwards(D.W.E.), Greg Swain (G.S.), and Danny Hooper (D.H.).

A major independent research company proved that the ADC XLM MKII incurred no perceivable record wear over the life of your records!
Since then ADC's massive research programme has created a new state-of-the art, top of the line model–the ZLM Aliptic–designed for ultimate stereo performance combined with the concept of zero record wear.

Greatly reduced tip mass

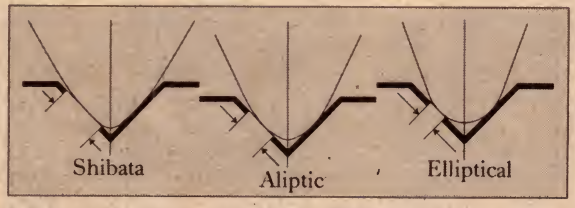
The ZLM has a tiny nude diamond with a ·004" x ·008" rectangular shank.
This achieves more lateral strength than the fashionable ·006" square shank, plus a 10% reduction in mass.
The diamond is mounted on a new tapered stylus, which again reduces mass.
In fact, the ZLM has only half the tip mass of the famous ADC XLM MkII.

Less mass by patent

The patented ADC Induced Magnet system, where the magnet is suspended over the moving stylus arm instead of being attached to it, inherently means less mass for the record groove to move. This, coupled with major innovations in the pivot block stylus suspension (which have solved deficiencies in the old system), has resulted in greatly improved frequency response characteristics.

New low-wear ALIPTIC shape

The ZLM has a new tip shape that combines the advantages of the elliptical and Shibata shapes, while eliminating their disadvantages.



It is basically elliptical (·0003" x ·0007"), but its bottom radius has been modified to extend the vertical bearing surface on the groove wall by 100%.
Large enough to greatly reduce record wear, while still small enough to prevent dirt particles being reproduced.
This new shape is called ALIPTIC.™

The best polish available

We decided it was worth the extra cost to get the ultimate polish for the ZLM.
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Complementing the range, we have the new four-cartridge QLM Mk III series, incorporating our new design criteria and exciting innovations like the Diasa (diamond + sapphire) elliptical tip.

ZLM Aliptic specifications

Diamond tip	Nude Aliptic
Tracking force	½ to 1¼ gram
Frequency response	10Hz to 20kHz ±1dB 20kHz to 26kHz ±1½dB
Output	1.0mV per cm/sec
Output balance	1dB max. diff.
Channel separation	30dB at 1kHz/20dB at 10kHz
Inductance	580mH
Resistance	820 Ohms
Load resistance	47,000 Ohms
Load capacitance	275pF
Cartridge weight	5.75 grams
Accessories	Stylus brush, screwdriver, all mounting hardware and signed frequency response curve.

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Feeling — Wild Cat Blues — Hiawatha — Sweet Georgia Brown — Louise — Elephant Stomp — Slab's Blues, etc.

Depending on their source and their age the tracks are a mixture of stereo and mono, but the latter have apparently been spiced with a touch of reverb to enliven the sound. If the program appeals, the pressing itself will certainly not compromise your enjoyment. (W.N.W.)

☆ ☆ ☆

BUNKY GREEN, VISIONS. Vanguard VSD 79413. Astor release.

Alto sax player Bunky Green gives us some very relaxed jazz on this record from Vanguard with seven fairly lengthy tracks: Alone Again Naturally — What I Did For Love — The Greatest Love Of All — Never Can Say Goodbye — Ali Theme — I Write The Songs — The Entertainer — Visions. This last title track runs for seven minutes and 48 seconds.

The backing group consists of Wilbur Bascomb, Angrl Allende, Mark Gray, Jeff Bova, Hiram Bullock, Steve Jordan, Michael Carvin and Bob Cranshaw.

It is interesting to see how synthesizer music of various types has come of age, in so many musical styles. It was not so long ago that "Switched On Bach" was such a sensation; now a big proportion of records have at least one kind of electronic instrument in the credits. (N.J.M.)

☆ ☆ ☆

LOS HERMANOS MALAGUENOS. Stereo, WRC S/5254. World Record Club Release.

If you're in the mood for some quiet Flamenco guitar music, this record could well satisfy you. Originally released by Harmonia Mundi, the record sleeve has little information about the artists, except that their names are Antonio and Marino. The eight tracks are: Bulieria — Solea — Rondena — Allegria — Taranta — Sigueriya — Milonga — Tiento.

The quality is excellent, with a close, almost intimate sound, making an ideal record for quieter moments' listening. (N.J.M.)

☆ ☆ ☆

SONGS OF JOY. Werner Muller & His Orchestra. Stereo, World Record Club WRC R-02409.

Turning aside from the ordinary middle-of-the-road standards, Werner Muller has built this album around titles and themes borrowed from the classics, but played in highly theatrical style. The titles:

Song Of Joy (Beethoven) — Theme, Piano Concerto No. 1 (Mozart) from "Elvira Madigan" — Forbidden Games (Trad.) — Aranjuez, Mon Amour (Rodrigo; Bontempelli) — Air On The G-String (Bach) — Theme From "2001" (Strauss) — Adagio (Albinoni) — Gymnopedie Nr 2 (Satie) — Bachianas Brasilieras Nr 5 (Villa Lobos) — Symphony No. 40 (Mozart).

As I said, it's all very theatrical, with strands of synthesiser and vocal effects threaded in with traditional orchestral sound. You may find it ingenious, interesting, entertaining — or you may see it as tedious tampering with traditional tunes that deserve temperate treatment!

The sound quality is okay, although not quite up to what one tends to expect from an album originally released under the Decca Phase-4 label. (W.N.W.)

☆ ☆ ☆

AKKORDEON HITS 5. Die Fidelen Limburger. Stereo, Europa (Astor) 111-104.

To judge by the jacket, this is the fifth album of "Akkordeon Hits" by a group comprising two accordianists, a bassoon player to provide the rhythm bass and a young blond lass on drums.

From the very first bars, the sound is unmistakeably central European and it whisked me back in time and place to a particular folk concert in Austria. Ah well . . .

The jacket lists a profusion of titles in English and German (?) but, with music like this, I doubt that titles really matter. There's an obvious sameness, yet an infectious sameness, nevertheless. But,

for the record:

Rivers Of Babylon — Mull Of Kintyre — Lazy Bumblebee — Love Is In The Air — Singing In The Rain — Bye Bye My Love — Heidi — Isabelle — etc.

The recording quality is well up to standard and, if you're at all partial to the happy European "compah" style, you'll enjoy it. (W.N.W.)

WINNIE. Winifred Atwell In Concert. Stereo, RCA VAL1 0170.

On January 30, 1976, Winifred Atwell made this live recording at the Revesby Workers' Club in Sydney — her first such recording in years. And it was obviously a happy occasion for both performer and audience.

Side 1 was recorded using a full grand piano and, backed by a small instrumental group is devoted to tracks like: Choo Choo Samba — Zorba's Dance — Burt Bacharach Medley — "Airport" Theme — Bumble Boogie — Macarthur Park — Hava Nagila — Medley including "When The Saints", "Alexander's Ragtime Band" etc.

On side 2, she resurrects "that other piano", for a honky tonk "Black And White Rag", followed by a singalong medley. Then comes "Tiger Rag" and four other medleys, with the audience having a ball and Winnie at her brilliant best, doing her own thing.

It's the hectic, happy sound of a workers' concert, very cleanly recorded and of generous length: just short of the label on both sides! If you like Winifred Atwell, you'll certainly enjoy this album. (W.N.W.)

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☆ ☆ ☆

A COLLECTION OF GOLDEN PERFORMANCES. Liberace. ABC Records (RCA) ABCA-30020.

By reason of his television appearances, we have come to expect a Liberace that is flamboyant, talkative, and involved in a constant two-way interchange with his audience.

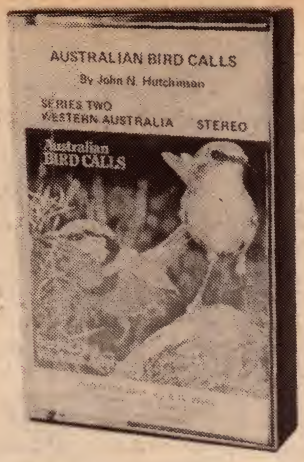
For this record there is no repartee, no audience and no applause. Liberace is basically the fluent cocktail pianist/entertainer, playing a highly ornamented lead to an instrumental backing group, in some dead quiet studio.

It is a generous program, however, with a total of 18 tracks on the two sides. To mention just a few: Lara's Theme — Spanish Eyes — East To Love — Yesterday — It Was A Very Good Year — Love Is A Many Splendoured Thing — Sunrise, Sunset — Try To Remember — Strangers In The Night — etc.

The sentimental nature of the program, its presentation and the tightly controlled dynamics rather belie its title "Golden Performances". My tip is that most will treat it as a soft lights and

LIGHTER SIDE — continued

Sounds in stereo from the West Australian countryside



AUSTRALIAN BIRD CALLS. Series 2 by John N. Hutchinson. Stereo cassette. From John N. Hutchinson, Balingup 6253, WA; price $8.00 incl. postage. Also available on disc for the same price.

If you're anything like me, you've probably determined on more than one occasion to make your own recording of bird sounds — but you've never quite got around to it! Well, John Hutchinson of Wildlife Sound Studios has deputised for you, using AKG, Grampian and Sennheiser microphones, mixers, switchers and a Nagra and a Uher tape recorder.

There's one factor for east coast dwellers in that the sounds featured on this recording are from forest and farmland birds of Western Australia, rather than the species found at the bottom of your garden. Even with those you know, you'll have to be prepared for a different (common) name and perhaps a noticeably different song.

As against series 1, this recording comes in stereo, with bird, bush or frog sounds blended by way of background. There are no announcements on the tape but the species and situations are explained in jacket notes, in the case of the disc, or in a physically much reduced copy with the cassette.

Quality is good and you won't be disappointed if you share John Hutchinson's interest in our feathered friends and their habitats. (W.N.W.)

sweet music sound; music for dining and relaxing with none other than Liberace to help set the mood! The quality is okay. (W.N.W.)

☆ ☆ ☆

STAGE. David Bowie. RCA CPL2 2913. RCA release.

This double-live album set contains 17 of David Bowie's great album tracks. The tracks on the album are: Hang On To Yourself — Ziggy Stardust — Five Years — Soul Love — Star — Station To Station — Fame — TVC 15 — Warszawa — Speed Of Life — Art Decade — Sense Of Doubt — Breaking Glass — Heroes — What In The World — Breakout — Beauty And The Beast.

The two record set involves some excellent live recording, for which credit must go to the RCA Mobile Recording Unit.

Anyone who attended the David Bowie concerts in Australia late last year, could revive the experience by purchasing this "live" set. (D.H.)

☆ ☆ ☆

SEA CRUISE. Jay & Germain. Celsius MLF 235. 7 Records release.

"Sea Cruise" is a disco album featuring great performances of the Beach Boys' hits.

The first track on side 1 is a medley extending for 11.51 minutes: Dance, Dance, Dance — Do You Wanna Dance — Surfin' USA — I Get Around — Wendy — Help Me Rhonda — Little Surfer Girl — Fun, Fun, Fun — Good Vibrations — Little Honda — Shut Down — Little Deuce Coupe — California Girls — Summer Finale.

The remaining track on side 1 is "Keep Doin' It".

Side 2 consists of three tracks: Dancer — Crazy Motion — Barbara Ann.

In many cases the vocals are similar to the original Beach Boys' sound. However, the up-tempo disco beat adds to the virility of this performance. (D.H.)

CRUISIN. Village People. RCA VPL1 4101. RCA release.

With two highly successful albums under their belt, Village People have come up with a third smash hit album entitled "Cruisin".

The opening track on the album "Y.M.C.A." is their latest single. Other tracks on the album are: The Women — I'm A Cruisin — Hot Cop — My Roomate — Ups And Downs.

Every track is characterised by a heavy disco sound — every bit as heavy as the masculine image they seek to project on the jacket. Pictorially, Village People consist of a policeman, a cowboy, a construction worker, an Indian, a leather man and a GI! (D.H.)

RENEE GEYER WINNER. Renee Geyer. RCA Victor VPL10164.

Personally, I think that you'd have to be a real Renee Geyer fan to fully appreciate this album. To my ear, the tracks have a sameness of sound, typical of the "low-key" jazz style encountered in a night club. The only really distinctive track is "Baby Be Mine", which has also been released as a single.

Other track titles include: Money (That's What I Want) — I Miss You — Save Me — Baby I'm The One — Sweet Kisses — The Magic Is Still There — Bad Side Of The Blues — Apartment C & D — I Don't Wanna Lose A Good Thing.

The album was recorded at Crystal Studios in Los Angeles, USA, and mixed in RCA's Sydney studios. The result is an album of excellent technical quality, if of somewhat unvarying content. (G.S.)

☆ ☆ ☆

BURGERS AND FRIES — WHEN I STOP LEAVING (I'LL BE GONE). Charley Pride. RCA Victor APLI 2983.

Charley Pride is in top form on this album, his deep smooth voice wending its way through 10 ballads and love songs. As usual, the backing musicians are kept in place, and never overshadow Charley's voice.

In order, the tracks are: Burgers And Fries — The Best In The World — Whose Arms Are You In Tonight — Nothing's Prettier Than Rose Is — Mem'ries — When I Stop Leaving (I'll Be Gone) — One On One — Where Do I Put Her Memory — You Snap Your Fingers (And I'm Back In Your Hands).

The two title tracks are the pick of the bunch, although the remaining tracks are also of a high standard. Recording quality is excellent, with a good stereo balance. (D.W.E.)

☆ ☆ ☆

VICTIM OF ROMANCE. Michelle Phillips. A & M Records L36541. Festival release.

This is Michelle Phillips' first solo album, although her pleasant voice should be known to many from her work with the Mamas and Papas. On this record she covers quite a wide range of styles, from country rock to romantic ballads. Best track is undoubtedly the title track "Victim Of Romance", which has overtones of the Beach Boys and a slight touch of the Phil Spector sound.

Other tracks, which are all quite pleasant, include Aching Kind — Let The Music Begin — Trashy Rumours — There She Goes — Paid The Price — Baby As Your Turn Away — Lady Of Fantasy — Just One Look — Where's Mine? (D.W.E.)

World Record Club recordings reviewed in these columns can be obtained only through the World Record Club Pty Ltd, 605 Camberwell Road, Hartwell 3124. Tel. (03) 29 3636.

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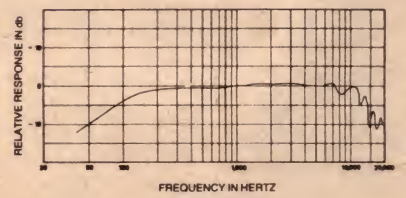
Some like it essentially flat...



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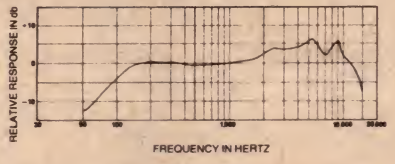
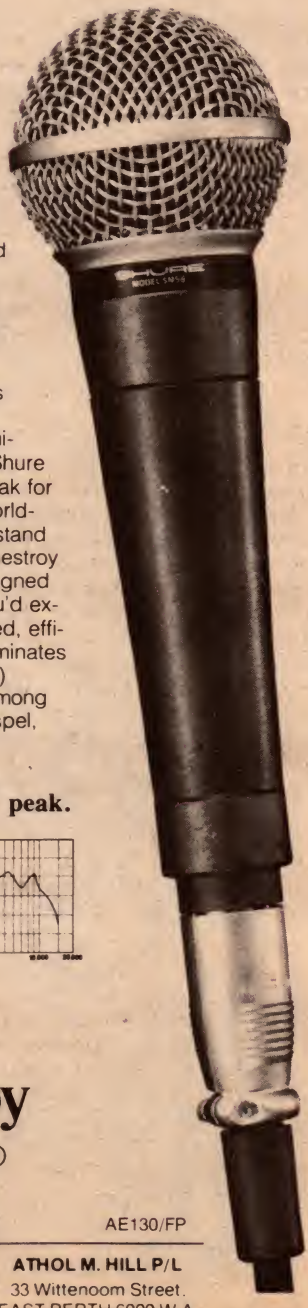
...some like a "presence" peak.





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Program a 2708 in under five minutes!

Simple EPROM burner suits SC/MP and 2650

Using only four low cost ICs, this single board design will allow any static microprocessor, such as the SC/MP or 2650, to program 2704 and 2708 type EPROMS. Programming time for 1K bytes is just under five minutes, and no special interface circuits are required.

by DAVID EDWARDS

The basic circuit configuration and idea used in this project came originally from one of our readers, Mr M.J. Ogden of Hope Valley, South Australia. As soon as we saw it, we decided that it was too good an idea to publish purely in basic circuit form. So with Mr Ogden's approval we have expanded the original concept into a full construction project.

Like all good ideas, Mr Ogden's is delightfully simple. PROM programming interfaces normally have to provide address and data latches, as this information must be held static during the relatively long periods taken to program PROM locations. But some microprocessors, like the 2650 and SC/MP, are static devices, and are capable of being forced into a "hold" or "wait" state without loss of data. This is to allow them to be used with slow memory or peripheral devices. Why not take advantage of this facility, and use the processor itself as the address and data latches for the PROM programmer?

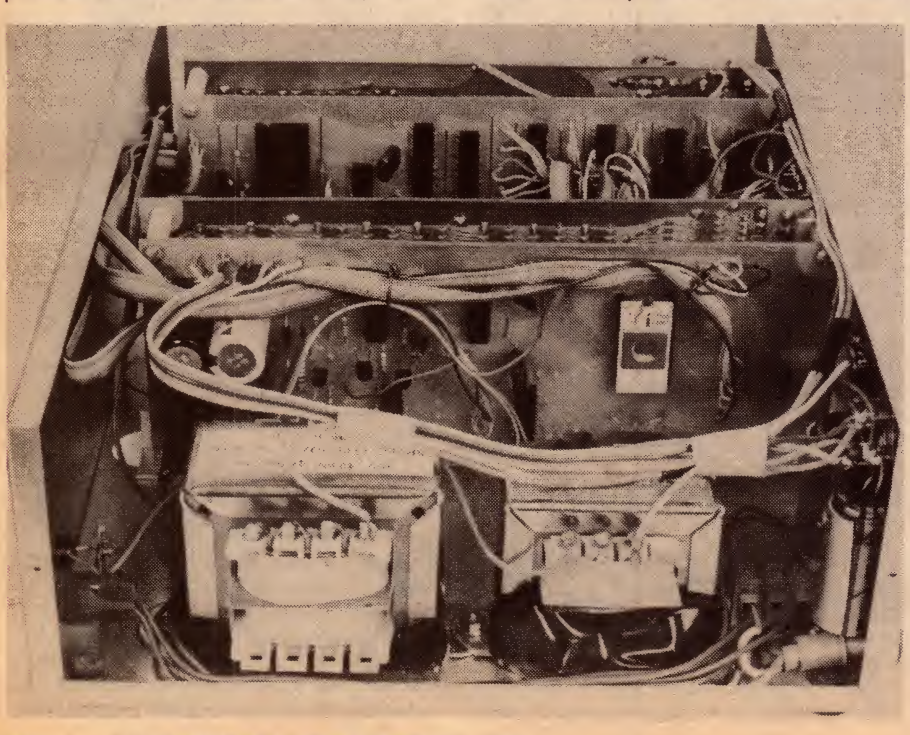
With static processors like the 2650 and the SC/MP the idea turns out to be very easy and straightforward. All that is necessary is to arrange simple logic so that to program each PROM location the processor is made to begin a normal instruction cycle storing the required data to the appropriate address, then "held" or frozen with the data and address information present on the bus lines until the programming circuitry has done its job.

Before discussing the operation of the circuit in detail, an explanation of the operation and programming requirements of an EPROM is in order.

The popular 2708 EPROM uses floating-gate avalanche mode MOS transistors as the storage cells. Stored charges on the floating gates are used to control the conduction of the MOS transistors, to determine whether they effectively store a "1" or a "0".

The floating gate's charge is produced by inducing a non-damaging avalanche breakdown in the drain-channel junction of the cell. High energy electrons from the avalanche breakdown are then injected into the floating gate, charging it negatively. Since the floating gate is surrounded by an extremely effective insulator, this charge will remain practically indefinitely, and hence the stored pattern will also remain.

To erase a programmed EPROM, the chip is irradiated with ultra-violet light. The resulting photons impart enough energy to the trapped electrons to allow them to escape from the floating



In this photograph, you can see how the new board fits into the 2650 Minicomputer case.

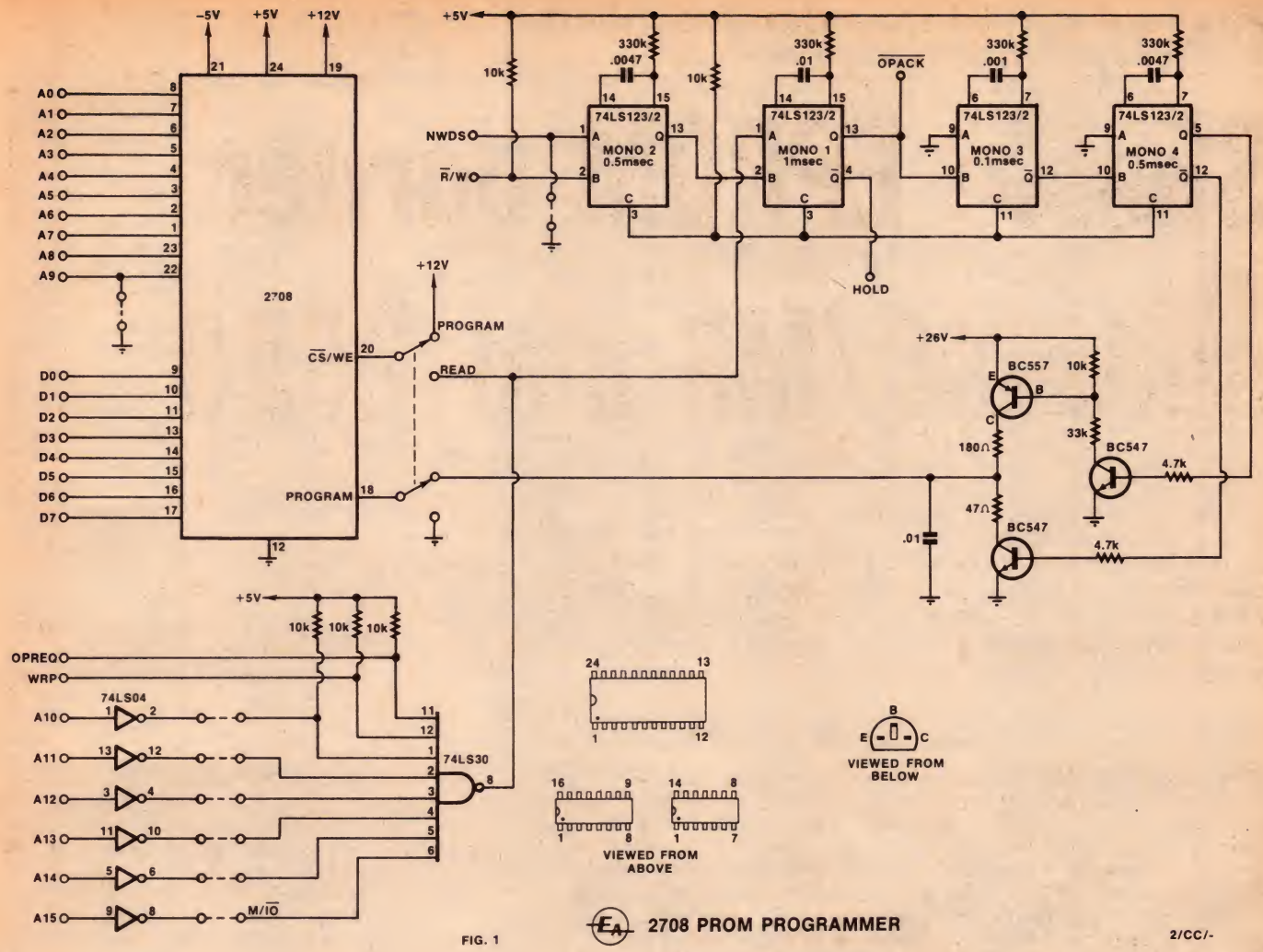


FIG. 1

2708 PROM PROGRAMMER

2/CC/-

gate, leaving it uncharged.

An erased EPROM has all memory cells effectively containing 1's, so programming consists of inducing avalanche mode breakdowns in the appropriate cells to produce the required zeros. In principle one programming pulse is required for each memory location. The appropriate address and data information must be applied to the address and data pins of the EPROM.

In practice, due to power dissipation limits, it is necessary to apply relatively short programming pulses, and to cycle repetitively through all memory locations until a sufficient number of programming pulses have been applied to each location.

Turning now to Fig. 1, we can see how the basic idea can be used to implement a simple EPROM programmer. The microcomputer's address and data lines are connected directly to the EPROM. In the read mode, a chip select signal is derived from the high order address lines by a decoder implemented with a hex inverter and an eight input NAND gate.

This decoder allows the EPROM to be patched into any available area of memory. To use the top 1K section of memory, it is not necessary to use the inverter; the address lines can simply be connected directly to the NAND gate.

In the program mode, the chip select input is connected to the +12V line. The output of the address decoder is now used to enable a monostable (mono 1) with a period of 1ms. This monostable is triggered from the output of a second monostable (mono 2), which itself is triggered from the write select signal.

Thus the first monostable is only triggered when a write instruction occurs to a valid EPROM address. The output of this monstable is used to drive the hold line of the processor, halting the write operation in midstream, and leaving the appropriate address and data information on the processor buslines. Fig. 4 shows the timing relationships schematically.

At the same time, a third and delaying monostable (mono 3) is triggered, with a pulse width of 0.1ms. The trailing edge of this pulse is used to trigger a fourth monostable (mono 4) which has a pulse width of 0.5ms. The outputs of this monostable are used to drive the programming pulse generation circuitry.

The programming pulse has an amplitude of 26V, and lasts for 0.5ms. Approximately 0.4ms after the end of the programming pulse, the output from the first monostable returns to the quiescent state, and the hold is removed from the processor.

Thus to program the EPROM, all that

Above is the complete circuit diagram of the programmer, while below is a diagram illustrating the timing relationships between the monostable multivibrators.

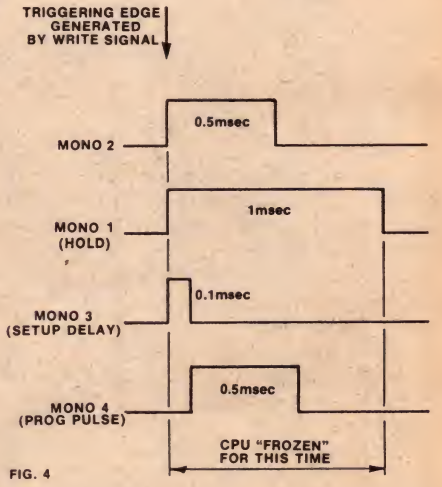


FIG. 4

2708 EPROM programmer

```
0440 08 0F C8 13 08 0C C8 10 08 0B C8 0D 08 08 C8 0A
0450 17 3C 00 3D BC 7C 00 3D BC 7D BC 08 7C 09 7B D9
0460 02 D8 00 C8 74 C9 73 08 6E 09 6D D9 02 D8 00 C8
0470 66 C9 65 E8 5E 16 E9 5C 17 3F 00 8A C9 83 CA 8A
0480 0C 84 25 14 3F 02 B4 09 F8 0E 04 26 DA 6E D9 6C
0490 1B 6A 76 40 77 02 75 18 3F 02 DB CD 04 51 CE 04
04A0 52 3B F6 DA 02 D9 00 CD 04 53 CE 04 54 3B EA CD
04B0 04 55 CE 04 56 07 00 05 05 06 2A 3B 9E 3F 02 86
04C0 05 05 06 74 3B 95 FF 05 1B 05 05 06 50 3B 8C 06
04D0 3A 3F 04 8C 3B E8 05 05 06 5F 3F 04 79 3F 04 40
04E0 07 06 3F 00 8A 20 C8 32 0C 84 59 EC 84 57 18 19
04F0 09 F7 3F 02 69 0D 04 5A 3B F9 04 20 3F 02 B4 FB
0500 04 07 06 3B DE 04 80 C8 11 3F 04 5B 1A 5A 08 0A
0510 1A 06 05 05 06 70 3B C3 9B 22 80 3B C1 0C 84 57
0520 CC 84 59 3B E5 1A 76 1F 04 C6 53 57 49 54 43 48
0530 20 54 4F 20 50 52 4F 47 52 41 4D 0D 0A 54 48 45
0540 4E 20 50 52 45 53 53 20 41 4E 59 20 4B 45 59 00
0550 53 57 49 54 43 48 20 54 4F 20 52 45 41 44 00 45
0560 52 52 4F 52 20 4C 4F 43 41 54 49 4F 4E 53 3A 00
0570 4E 49 4C 00 50 52 4F 47 52 41 4D 4D 49 4E 47 0D
0580 0A 00
```

FIG. 5

This hex listing is a 2650 version of the program required to control the EPROM programming operation.

Shown below is the power supply circuit. The components marked with an asterisk (*) are already present in the 2650 Minicomputer.

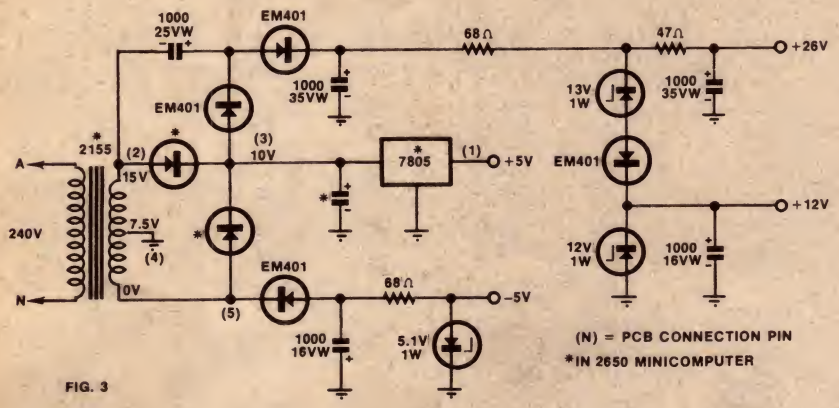


FIG. 3

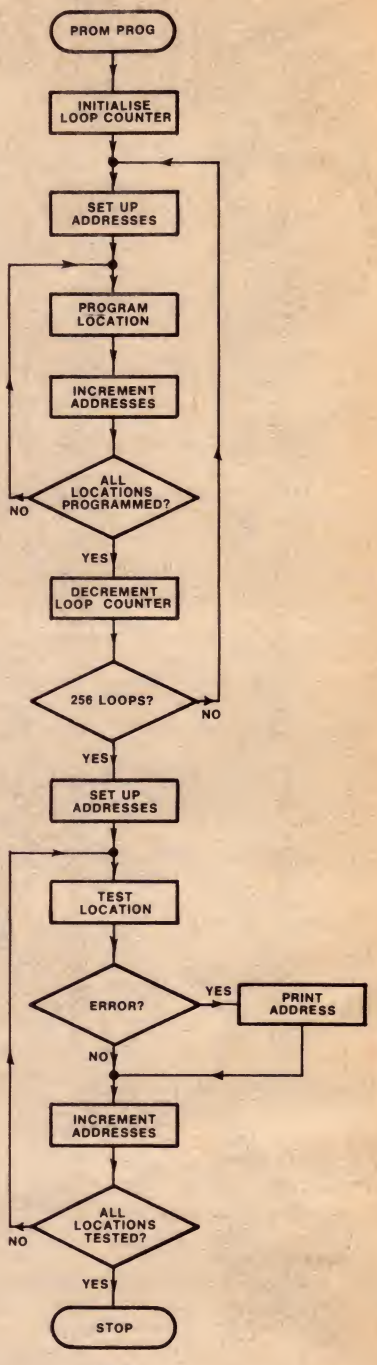


FIG. 2

This is the flowchart for the controlling program. Use it to write the routines required by your processor.

is required is to switch to the program mode, and then to program the processor to write the appropriate data to each location in turn, repeating this writing sequence until the required number of programming pulses have been applied to each location.

All of the timing requirements are provided by the four monostables, all that the program has to do is provide a repeated "block move" function. A block diagram of a simplified routine to do this is shown in Fig. 2.

Power supply requirements for the 2708 are quite complicated. —5V, +5V and +12V supplies are required for normal operation, while +26V is required during programming. Fig. 3 shows how these voltages can be derived from a standard transformer, using zener diode regulators. The +5V supply can be obtained from the existing circuitry.

We have designed a suitable printed circuit board for mounting the EPROM, address decoder, monostables and power supply components. It is coded 79upl, and measures 218 x 81mm.

Provision has been made so that this board can be used with any suitable processor. Positive and negative going hold signals are available, and the write monostable can be triggered from either positive or negative going signals. Any starting address for the EPROM can be decoded, up to H'7C00.

Construction of the board should be well within the capabilities of most enthusiasts. We recommend that a good quality socket, preferably a zero-insertion force type, be used for the 2708. The remaining ICs can be soldered directly in place.

The programming switch can be mounted directly on the board, using tinned copper wire, or it can be extended with a cable if desired. It should be placed in a position where accidental operation is unlikely, to ensure that no accidental programming occurs.

As the board has to be wired directly to the address and data busses, we recommend that it be mounted in the main computer case. Make sure, however, that access can be gained relatively easily to the EPROM socket and the read/program switch.

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2708 EPROM programmer

In order to illustrate the use of the Prom Programmer board, we have used it with the 2650 Mini Computer. In this case, the M/IO-bar signal is connected to the address decoder instead of AD15. The OPREQ and WRP signals are also connected to the decoder, using the spare inputs to the NAND gate.

The A input of monostable 2 is grounded, and the R-bar/W signal applied to the B input. The Q output of monostable 1 is used to drive the OPACK-bar line. We elected to make the EPROM occupy locations from H'3C00 to H'3F00, the last 1k of page 1. To do this, it is necessary to apply AD10, AD11, AD12, AD13, and AD14-bar to the NAND gate.

We chose this area so that it would be relatively easy to provide a small amount of RAM in the same page. This is required because of the limitations of the 2650 absolute addressed memory reference instructions. We used the spare RAM sockets on the main CPU board, wired up as the first 4K of page 0.

The 2650 program we developed to control the Prom Programmer is given as a hex listing in Fig. 5. It occupies locations H'0440 to H'0581 inclusive, and is not easily relocatable. To call the program, which uses Pipbug routines CRLF, COUT, GNUM, CHIN and BOUT, type G492 XXXX YYYY ZZZZ cr, where XXXX and YYYY are four digit hex numbers represneing the start and end addresses of the area of RAM to be copies into the EPROM, and ZZZZ is a similar number representing the address of the first EPROM location.

The program will respond with the message "SWITCH TO PROGRAM THEN PRESS ANY KEY". The read/program switch (it should normally be in the read mode) is now moved to the program position, and any keyboard key of the terminal pressed.

The program will then respond with the message "PROGRAMMING", and then appear to do nothing while it actually programs the EPROM. A 1K "burn" will take nearly five minutes, shorter burns proportionately less.

When the programming is complete, the program will print out "SWITCH TO READ THEN PRESS ANY KEY". When this command has been carried out, the program begins to verify that the data has been stored correctly in the EPROM. First it responds with "ERROR LOCATIONS:" and then gives a list of any locations not correctly programmed. If there are no errors, the message "NIL" will be displayed.

If you obtain a small number of errors, this indicates that there was insufficient programming at these locations. To remedy this, simply repeat the programming process for all of the block you are attempting to program.

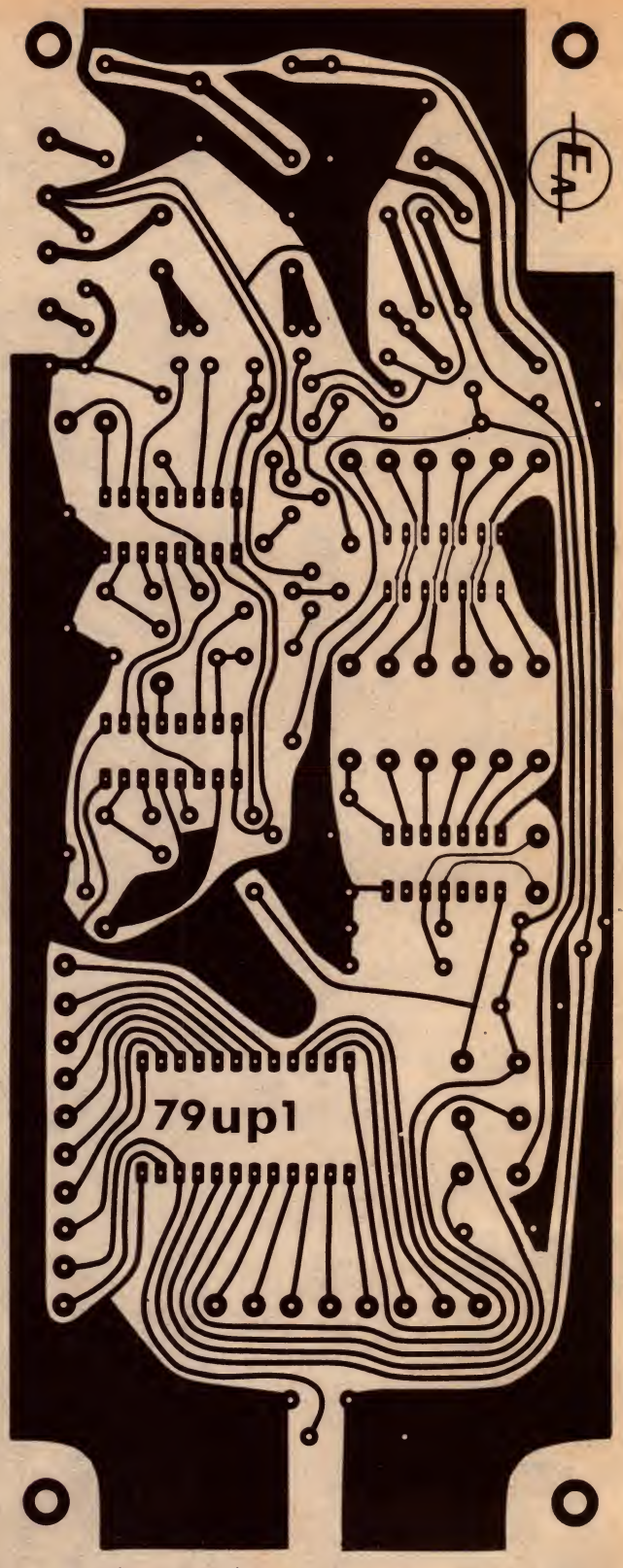
To use the programmer board with a SC/MP system, connect the address and data lines to the appropriate points on the board. Insert the two 10k pullup resistors on the OPREQ and WRP lines, but leave these lines unconnected. The Q-bar output of mono 1 is used to drive the SC/MP HOLD line, while the SC/MP's NWDS signal is used to drive the A input of mono 2. The B input of this monostable is pulled permanently high by the 10k pullup resistor provided.

That is all the hardware alterations required, apart from providing the appropriate power supplies. Of course, you will need to write an appropriate controlling program, to output the required data to the EPROM. Use the flow chart provided as a guide.

Do not attempt to program a block of memory smaller than about 256 bytes, as otherwise the power dissipation limits of the 2708 may be exceeded. If you have to program a small block, reduce the number of program loops (specified in location H'04B6), by a proportionate amount, and then program the PROM repeatedly until a correct burn-in is achieved.

Once an EPROM has been programmed, it is recommended that the transparent quartz window above the chip be covered with an opaque layer, to prevent possible leakage currents generated by ambient light from causing malfunctions.

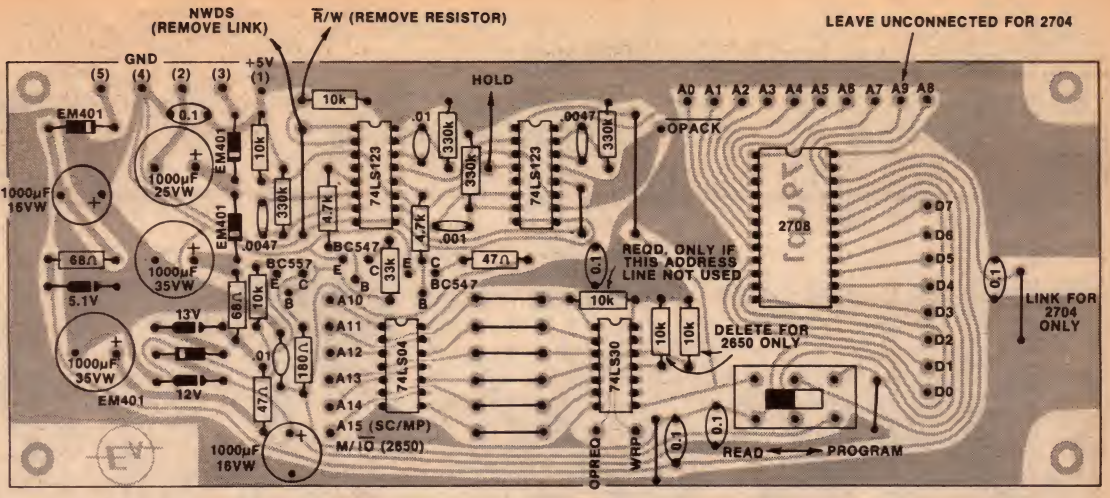
If you wish to erase a programmed 2708 EPROM, you will need a source of ultra-violet light with a wavelength of 2537 Angstroms. A suitable source is the TUV 15W lamp (cat. no. 57415P/40), available from Philips. It fits in a standard 20W fluorescent holder, and should be ordered from an elec-



You can either copy this actual sized reproduction of the PCB artwork,or trace it directly. Alternatively, commercial boards should be available in due course.

Use the overlay diagram at the right when you are assembling the PCB. Note that address decoding is achieved by the address wire connections, using the hex inverter as required.

The photograph below is of the completed prototype. Note in particular the way in which the address wiring has been completed for addresses 3C00-3FFF.

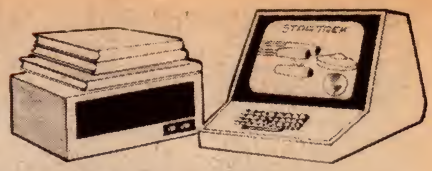


trical or lighting store.

With the window of the 2708 about 25mm from the tube, an exposure time of approximately 30 minutes will be required. This will erase all sections of the device. Note that lamps of this type must be used with caution, as eyes and skin may be affected by long exposures.

In the next issue, we plan to publish details of suitable 2650 utility routines for programming into a 2708. These will include a hex input routine, a hex listing routine, a block move routine, a search routine and a tape verify routine, and possibly other useful sub-routines.

Microcomputer News & Products



Melbourne's computer show

ABOVE LEFT: Near the Futuretronics stand — it was hard to get any closer! ABOVE: Young enthusiasts at the Computerland stand.

Despite its suburban venue, Melbourne's first Home Computer Show was voted an outstanding success by exhibitors and organisers alike. Held in the Box Hill Town Hall over the weekend December 9-10, the show attracted capacity crowds; at times the front doors had to be shut, to allow those inside to thin out before more were admitted.

When the doors finally shut on the Sunday night, just on 5700 people had paid to see and use the latest in home and small business computers. Although most had come from the Melbourne area, a significant number had travelled much further distances. Some had even flown in from interstate.

For virtually all of the weekend crowds were many rows deep around most of the stands. Almost every exhibitor provided visitors with the opportunity to try out equipment for themselves, and young and old alike accepted the challenge. At times the only problem was to prise young enthusiasts away from the terminals, to let others have a try!

A number of the exhibitors were selling direct to the public, and reported healthy sales of items such as video games and instructional books. Others reported many orders and preliminary inquiries.

Many of the names on the stands will be well-known to EA readers: SM Electronics; Pennywise Peripherals; AJF Systems and Components; Sontron Instruments/The Byte Shop; ASP Microcomputers; Futuretronics; Abacus Computer Store; Rod Irving Electronics; Strand Electric; Dick Smith Electronics; Electronics Today International; Delta Scientific Electronics; RML Computers; Computerland

Outside the Tandy TRS-80 stand — again it was hard to get closer!

Australia; South West Electronics; Box Hill Technical College; Honeywell; The Dindema Group; AJ & JW Dicker; Tandy International; Warburton Franki Industries; and Informative Systems.

All told, the show was such a success that the organisers are now giving serious thought to running a similar show in Sydney, early this year.

Low cost terminal

E & M Electronics has added a new model to its range of VDU products: a low cost interactive teletypewriter replacement which connects to a standard video monitor or TV receiver. Designated the EME-20, the new terminal incorporates the EME-2 module announced in the August 1978 issue. It also features a Hall-effect keyboard for improved reliability.

The EME-20 provides three serial communications options: TTL, 20mA current loop or RS232C, available via a standard 25-way D connector at the rear. Also at the rear are two switches, one selecting baud rate and the other half or full duplex. Baud rates available are 110, 300, 1200 and 9600, although other speeds are also available. A solid state alarm is mounted at the rear of the unit, providing an audible signal in response to the BEL control character.

The terminal is available in both a fully wired and tested version and a kit version. The fully assembled version sells for $540, with optional RF modulator extra; the kit version (EME-20K) sells for $450 and includes the modulator components.

Further information is available from E & M Electronics Pty Ltd, 136 Marrickville Road, Marrickville, NSW 2204. Telephone (02) 51 5880.

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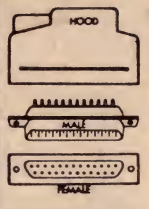

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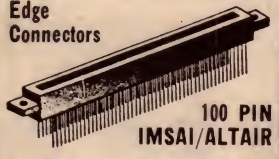

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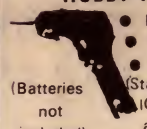

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by IAN P. PHILLIPS

Villanova College, PO Box 231, Coorparoo 4151.

There I was with several thousand dollars burning a hole in my pocket. I knew I had to buy three small computers, but what kind should I buy?

Much of the money was provided by a grant under the Special Projects Program of the Schools Commission for me to do development work in CAI (Computer-Assisted Instruction). The fact that I was using taxpayers' money was itself a heavy responsibility. I could not afford to be wrong.

I had another reason for not wanting to be wrong. For several years I had been sure that computers could be used as great instructional media. I didn't really want to teach students about computers, but rather to use computers to help students learn about English, chemistry, etc.

The machines had to be reliable, easy to operate, easy to expand. They had to be disarmingly simple in appearance and rugged enough to withstand the press of young, excited fingers. Repair facilities has to be readily available.

It was after I had actually ordered the Apples that I began to get the jitters. How could I have been so silly as not to order an S-100 machine? But I calmed my fears with soothing philosophical reveries about the precariousness of human existence, about the nature of judgement itself and about Apples.

The Apple-II Computer is, as it turns out, a very simple machine. It is a single-board computer based on the 6502 microprocessor. On that board is the 6502 and supporting circuits, 8k of ROM and sockets for 4k more, sockets for up to 48k RAM, complete video circuitry including two kinds of colour graphics, audiocassette interface, a two-inch speaker, a socket to accept the keyboard cable and a "Game I/O" socket. Also on the board is a "motherboard" section for the 50-line Apple-bus with eight connectors soldered in.

The case includes this main board together with a keyboard and a power supply. In Australia, the machine comes with a 240V power supply and with an extra board which converts NTSC colour to PAL colour. I bought our machines with 16k of RAM installed, and I could not recommend less.

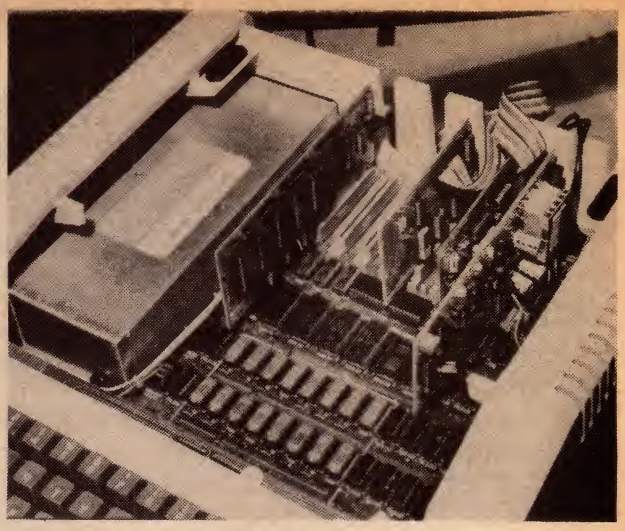
The video output is uppercase only in 24 lines of 40 characters. In graphics mode you can have a grid of 40 x 40 little squares, each one being able to be set to any of 16 colours. Below this grid remain four lines of ordinary text display. In high resolution graphics mode you can have a grid of 280 x 160 points with four lines of ordinary text display.

I have been disappointed with the RF output and must recommend that video monitor be used. I believe that the colour is of no great value for anything except games, but that the high resolution graphics does have great potential. Apple Computer Inc is certainly doing a great deal to help simplify the difficult task of programming in graphics. Their latest version of BASIC allows such a statement as HPLOT 1,49 to 200,142 which plots a line joining the two points.

The keyboard is sturdy and well-constructed. However, the RESET switch is a key on the keyboard and it is adjacent to the RETURN key. Things have a habit of coming to a grinding halt at precisely the wrong moment because the student pressed RESET when he meant to press RETURN. It is such a poor design feature that I have at last decided to "do a hack" and shift the RESET key.

The audio-cassette interface at 1500 bits per second is surprisingly fast and surprisingly reliable. If you are very

Here is the Apple-II together with optional colour TV receiver, floppy disc drive and video game controls. (Pictured by courtesy Computerland Australia).



In the picture at left, the attractive young lady is the only item not available in an Apple system! Above is a view inside the Apple itself. (Courtesy Computerland).

careful about using the digital counter on the recorder, there should be no problems. I have students as young as 10 years old using the machines, and they can handle the cassette interface well. It is certainly the least convenient part of the system — but that is true for all computers of this class. We are waiting for the good fairy to provide discs.

The Game I/O connector is a 16-pin IC socket which provides four TTL lines out, three TTL lines in, a strobe, +5V supply and lines for four pots. It is one of the best features of the Apple. It is therefore a shame that it is so poorly located. It is virtually inaccessible if you have boards plugged into nearby connectors on the motherboard.

There are a number of plug-in peripheral boards already available for the Apple. The NTSC-PAL board comes as standard in Australia. There is a wire-wrap prototyping or "hobby" board available from Apple for less than $30. It looks like good value for anyone able to deal with hardware innovation.

There are two other boards available from Apple — a parallel printer interface and a 300 baud serial interface. They are particularly flexible and well designed boards, and very easy to interface to your software. But to my mind they are ridiculously overpriced at more than $200 each. Happily there are independent manufacturers offering parallel and serial boards at very much cheaper prices. These do not offer quite the same ease of use as the boards manufactured by Apple, but the savings are considerable.

Another board available from an independent manufacturer is one that enables remote control of electrical devices by sending signals along the AC power line. Still another board enables the programming of 2716 EPROMs. These EPROMs can then, with an adapter, be plugged into the empty ROM sockets on the main board or into the sockets of Apple's own ROM/PROM board.

The Apple-II has considerable and useful software. The on-board ROM contains a cut-down BASIC, and a powerful monitor. Integer-BASIC is a very convenient piece of software, although limited to 16-bit integer arithmetic. In many other respects it is an improvement on standard BASIC. It allows variable names up to 100 characters long. It allows multi-statement lines, it has strings and it has good debugging facilities. Its most convenient feature is that it is there when you power-up, and no glitch can overwrite even one bit of it.

Another version of BASIC, called APPLESOFT, comes on cassette. It occupies 10k of RAM and is the 6502 version of Microsoft BASIC, also known as Altair BASIC. Apple have added extensions, particularly in the area of graphics. It is a very good extended version of the language, with 9-digit precision. It is now available on a plug-in ROM board for $120 (not bad for 10k!). We now have just one of these boards. It is great — when we get rich, we'll buy two more.

The on-board ROM includes a 2k monitor, plus a "mini-assembler". The monitor allows for examining and changing any memory location. You can move a block in memory, verify a block, read and write cassettes, trace and single step any program. You can set input/output ports, set normal or inverse video, and do hex arithmetic. The mini-assembler and dis-assembler are limited in scope, but very adequate for a surprisingly large number of purposes.

The Apple-II is, then, a very impressive machine, one well-suited to being used in a CAI project. Our progress here is very slow, but that has more to do with the nature of the institutional process than with the Apple. My principal task is to persuade teachers with no knowledge of or interest in computers that such machines can be very useful tools. To this end, I have just completed a software package for the Apple which will enable the most inexperienced person to write quite powerful tutorials.

While the Apple-II is a great machine, life is never without its upsets. Our first one developed a puzzling intermittent fault. Our Sydney supplier, Electronic Concepts (otherwise known as Computerland) returned it to us early in June, unable to find the fault. Meanwhile we procured two more Apples from them, one of which never operated owing to a faulty IC. This machine was instantly replaced. The first computer was still causing problems and Electronic Concepts replaced it at the end of July.

I would be surprised if other purchasers of the Apple-II had as much bad luck as we had. But our experience would make me very wary of buying from anyone but a thoroughly reputable dealer with good repair facilities and plenty of stock.

What about those early jitters I had? Well, the Apple-II is still not S-100. Not only do I not have the jitters about that, but I now cannot remember what was supposed to be so great about S-100.

The best feature of the Apple-II is that it is a single-board machine and thus has greater inherent reliability. I love the BASIC-in-ROM, and the graphics facilities are superb. The Apple-II is not without flaws and it is not as cheap as the PET, but it is available off the shelf now and it is a very good computer. I wish we had a dozen; maybe if that good fairy. . . .

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7406	.50
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4008	1.25
4010	1.25
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Looking for an elegant way to expand a Motorola MEK6800D2 evaluation kit, without spending too much money? If so, Stewart Electronic Components have some products which should interest you: a nine-slot backplane PCB with provision for active termination, a matching card cage, and heavy duty power supply components.

Probably the main item of interest is the model JBP680 backplane, a solidly-made double-sided PCB "mother board" with provision for up to nine of the 43/86 way edge connector sockets used by both the D2 kit PCB and those made by Motorola and others for Exorciser systems.

The backplane is a little unusual, in that the earthed groundplane is on the top or connector side of the PCB. This provides better shielding of the active bus lines and hence minimises radiation.

The PCB used for the backplane is of 2.4mm thick fibreglass, providing adequate mechanical strength. It also establishes a suitable characteristic impedance for the buslines, which act as microstrip lines in conjunction with the earthed ground plane.

A further unusual feature of the backplane is that provision is made for active termination of the buslines. While this may seem to be "gilding the lily" where a relatively small system is concerned, the designer argues that the benefits are well worthwhile. In some notes sent to us with the sample backplane reviewed, he points out that even in small systems some form of busline termination is desirable in order to prevent subtle troubles caused by ringing.

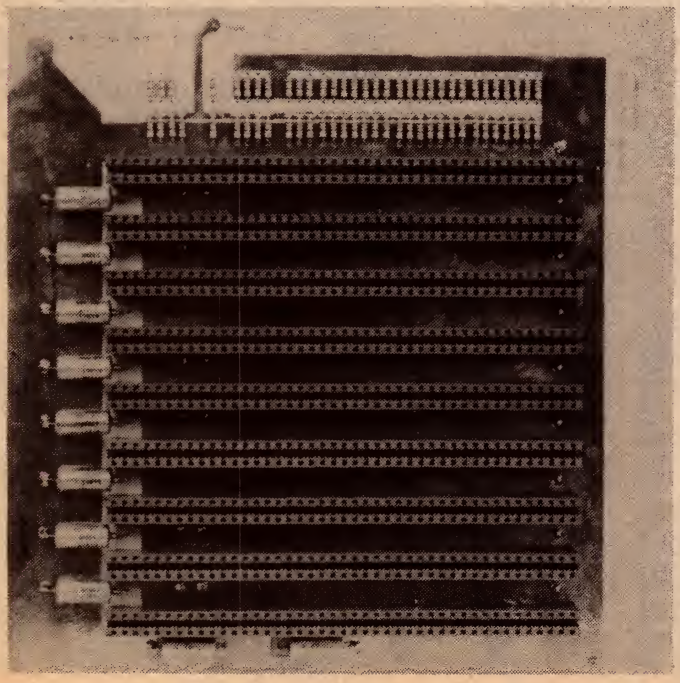
If the only termination on the buslines is provided by device inputs, ringing tends to be produced because of the high input impedance. With TTL type devices the input impedance is also non-linear.

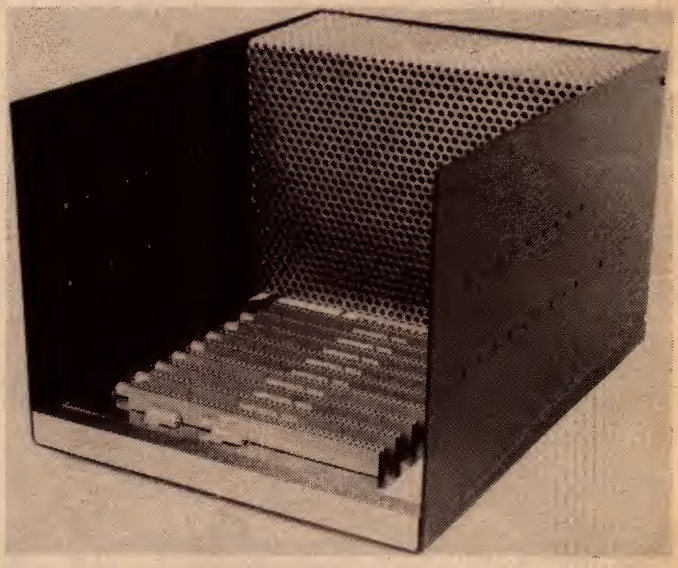
Using a ground plane on the backplane tends to further accentuate the problem, as this lowers the busline impedance.

The simplest way of providing some form of termination is to use pull-up resistors to the 5V line. This can give some improvement, but the resistors cannot really be made low enough for correct termination without absorbing most of the IOL current capability of the busline drivers.

Currently an alternative method is to use resistive voltage divider terminations, with each busline connected via a 360ohm resistor to the 5V line and a 390ohm to ground. This provides reasonable termination, but as each divider draws 6.7mA from the supply the total supply drain is significant.

A third and more attractive approach is to use active termination. This involves the use of a small auxiliary power supply to generate 2.6V at a very low source impedance. The buslines are then each connected to the 2.6V supply via a suitable series resistor, typically 270ohms, which forms the actual ter-





At left is the JBP680 backplane, with all edge connectors and other components fitted — including the series resistors in the active termination circuitry. Above is a view of the JCG680 card cage, with the backplane in position.

NATIONAL ANTHEM

ALL THE NEWS THAT FITS

A Review of New Products and Literature from National Semiconductor • Volume 5 No. 3

One Part for Many Needs: Adjustable Voltage Regulators

National has expanded its family of 3-terminal adjustable voltage regulators to provide you greater flexibility and the convenience of stocking only a minimum number of parts.

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Silicon Software

How's that again? Silicon software? Yes, that's right. Our family of Maxi-ROMs — 32K- and 64K-bit read-only memories — are the base upon which we're building a family of readily available software...canned software, if you will. Until now, the programs that we're loading into these large ROMs have been available to you and your system only by loading them from disk into RAM. So far, we've got two high-level languages canned and available.

The first canned language, INS8295, is aimed at the control area, as typified by SC/MP-based (INS8060) systems. The INS8295 has loaded into it the 4K-byte, National Industrial Basic Language, which you already know as NIBL.

The second canned and available language is the INS8298E Basic Interpreter for 8080-based systems. This 8K-byte language is perhaps better known to you as LLL — the Lawrence Livermore Labs Basic, a very general Basic package.

We're looking into other software packages, as well — Micro-Soft Basic, for example — because canned software is a powerful concept: anything heretofore loaded from disk into RAM can now be made available in the system, and immediately so. Besides saving valuable RAM space, canned silicon software greatly speeds program development. With it, you can communicate with a CPU in English, and with very simple statements. You need not know the CPU's architecture, nor need you be a sophisticated programmer. With canned software, if you can say, "When X happens, then do Y," you've got it made.

Stay on TOP of It

To insure that *all* your people have all the instruction they need for full use of your microprocessors, send them to NSC's regular courses offered on both the East and West Coasts:

"Microprocessor Fundamentals" — for engineers/managers/technicians with little or no experience on computers. This 5-day course provides instruction on microprocessors and their applications, as well as extensive practical lab sessions on development systems and microprocessor programming. It costs $495.

"Complex Peripheral Chips" — for engineers who already have system design experience but who need further information on application of the complex peripherals such as floppy disk, CRT and SDLC controllers. The course covers about 20 complex support chips and their use. It runs 3 days, has no lab sessions, and costs $395.

"8060 SC/MP Applications" — for the design engineer who wants to know how to design a system with SC/MP or the 8060 microprocessor. Both hardware and software design techniques are discussed, including the NIBL language and the LCDS and USDI systems. This 5-day course includes extensive hands-on time and costs $495.

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We now have FOUR single-chip data acquisition systems, all available in military as well as commercial specs, all at low, low prices.

Our latest entry is the ADC0808/0809 8-Bit A to D Converter, similar to our recent ADC0816/17 8-Bit A/D Converter, but featuring 8-channel input (rather than 16) and a 28-pin package (rather than 40) for lesser requirements and a smaller package.

Each of the 0808/09, 0816/17 devices consolidates an entire data acquisition system on a single chip — an industry "first." This allows direct access to 8 or 16 single-ended analog signals, eliminates the need for external zero and full-scale adjustments, and provides easy interface to microprocessors.

All four chips offer very high accuracy (1/2 bit for the 0808 and 0816) with high speeds, minimal temperature dependence and minimal power consumption. And all four chips are now also available in military temperature ranges (−55° +125°C) and specs. Check the data sheet for details.

Because these devices consolidate many functions on one chip, you save money. Because they come from NSC, a high volume producer, the price is right.

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MM2102A/MM2102AL 1K x 1 16 pin
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MM5257/MM5257L 4K x 1 18 pin
(a pin-for-pin replacement for the TMS4044)

All are available in standard or low power and in selected speeds from 200 to 450ns. All feature single 5V supply (TTL compatible), TriState® outputs for bus interface, and static operation. No clocks or refresh needed.

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We've just introduced a one bit-slice microprocessor that's so fast no one in the world can catch up with it. With speeds below 100 nanoseconds at regular power levels, it's half again as fast as our competition's functional equivalent.

What is it? — the new super-speed version of our fast 2901A — the IDM2901A-1.

Why is it so fast? — because it uses a new proprietary process called SCL™ which combines ECL and Schottky.

Look at the specs:

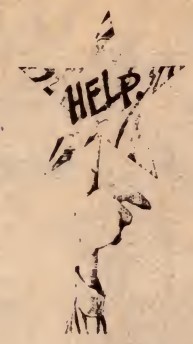
	Typical	Commercial	Military
Over Data	25°C (5V)	0°-70°C (4.75-5.75V)	55° + 125°C (4.5-5.5V)
A,B Inputs | Y Output	37ns	50ns	60ns
C_n | Y Output	18	25	32
D Input | Y Output	20	32	40
Clock | Y Output	35	50	60
Minimum Clock Period	45	60	75
Read-Modify-Write Cycle	45	60	75

Then get there fast and first with our IDM 2901A-1.

A

We've Got It ALL TOGETHER

Integrated is the key word for NSC's new Development System — STARPLEX™. Starting with the single purpose of making life easy for the user, we specifically planned the software to meet the needs of the design engineer, programmer, or first-time user. Then we designed the hardware around the software.



By utilizing three built-in microprocessors, communication with STARPLEX™ has been simplified. For instance, a "what-to-do-now" manual has been built right into the programming. A single keystroke on the "Help" button gives the user instructions, in plain English, on the CRT terminal. This alone saves your design engineers *hours* of hunting through instruction manuals.

Another example — errors are immediately displayed on the CRT in easy-to-understand English, eliminating cross reference to a manual for decoding. Also, a debug program is already built in and can be activated by a single keystroke.

Need to make a few changes? A single stroke of the Edit key displays the text on the CRT. Four arrow keys ↑ ↓ ← → help you locate the cursor blip on the problem area. Then one, plainly marked key instructs STARPLEX™ to insert a line or character, or delete, or scroll the page, etc.

We've planned for high-level computer languages too. The software includes FORTRAN, BASIC and Microassembly languages. One key stroke starts up any of the language processors.

Compact, modular, flexible, STARPLEX™ also includes a thermal printer (50 characters per second), a main keyboard of 58 alpha-numeric ASCII keys, 38 additional keys, two 256K byte floppy disks, 64K RAM, and an optional PROM programming station.

Both the hardware and software are expandable to allow you to plug in your own previously designed programs or functions and to give you space for future needs.

All of this at a price you wouldn't believe ($13,800). STARPLEX™ — saves money and saves time.

Low Cost — Full Featured

Our new MA1020/MA1022/MA1023 series of LED clock modules offers a full spectrum of functions and features at a price that gives you more function-per-dollar than any other existing clock module.

Available in 0.84", 0.5" and 0.7" display heights, the MA1020/1022/1023 also features PM, Colon and Alarm indicators, Power Loss indicator, multiple 9-minute Snooze, "one-finger" Sleep setting, and easy-to-use "Fast" and "Slow" controls.

Also, there's 12 or 24-hour operation, direct display drive, battery back-up, 50 or 60 Hz operation...and the list goes on and on.

Applications for these very compact clock modules include clock radios, timers, alarm clocks, instrument panels, controllers, etc.

Data sheets for our MA1020/1022/1023 series are available from National Semiconductor Corp. or your local sales rep, and the product is in stock now.

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- ☐ MA1020/1022/1023 LED Clock Modules
- ☐ Starplex Development System
- ☐ ADC0808/0809 D/A System
- ☐ LM131A/131, 231A/231, 331A/331 V-to-F Converters

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National's LH0075 (positive) and LH0076 (negative) voltage regulators eliminate most or all external components usually associated with precision programmable sources.

For example: Appropriate connection of its external pins makes available + 5, 6, 10, 12, or 15 V from the LH0075; and − 3, 5, 6, 8, 9, 12, 15, or 18 V from the LH0076. And these outputs are accurate to 0.1%.

But if you insist on some other voltage, then one external resistor is all you need to set these regulators' outputs between zero and (±) 27 V.

The output current capability of both units is high — 200 mA. And if you'd like current-limited operation, simply add two more resistors to set the limit at any desired level between zero and 200 mA.

Featured specifications include (for the LH0075 and LH0076, respectively): line regulations (typ.) of .008%/V and 0.005%/V; load regulations, 0.075% and 0.02%; ripple rejection, 80 dB and 70 dB.

Remote voltage sensing and programming are not only possible, but eminently practical. And both regulators are specified over the full military temperature range of − 55° to + 125°C; the LH0075 is also available in a 0° to + 70°C version, and the LH0076 in a − 25° to + 85°C version. All are packaged in 12-pin, TO-8 metal cans.

What's That, Neighbor?

You say you need a six-digit display about half an inch in size, and it's gotta be common cathode multiplex, and you need two mounting holes, and you've been buying the DL6500 but thought you were sole sourced?

Well, you're not. NSC makes a direct replacement, a pin-for-pin equivalent, a "Yank-theirs-out-and-plug-ours-in." It's called the NSB5931 and it's available today. Contact your local Rep or Distributor.

There's More to LEDs Than Red

NSC has a full line of red lamps — but that's not all. We also make green and yellow ones. The following T1¾ size, high-efficiency lamps are now available in a new "A" version with higher light intensity, lower prices:

NSL5252A	Green Transparent Lens
NSL5253A	Green Diffused Lens
NSL5352A	Yellow Transparent Lens
NSL5353A	Yellow Diffused Lens

Featuring low power consumption and a doubled light intensity, these yellows and greens are a perfect complement to our NSL5050 family red LEDs.

Recent Literature of Special Note:

AN203: Bit Slice Microprocessor Design Takes a Giant Step Forward with Schottky-Coupled-Logic Circuits
Linear A + , B + Brochure
BIFET™ and BIFET™ II Op Amp Brochure
Audio Radio Products Brochure
Voltage Reference Guide
A Spectrum of IC Components for Minicomputers (Brochure)
Reliability of Schottky PROMs (Brochure)
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Linear Databook
Data Acquisition Databook
Memory Databook
Discrete Databook
Interface Databook

We Know a Good Driver When We See One

National's DS3245 is a quad, bipolar-to-MOS clock driver with DTL/TTL-compatible inputs. Pin- and function-equivalent to Intel's 3245, our DS3245 is designed expressly to provide the high output current and voltage capabilities necessary to drive into the high capacitance of large, N-channel MOS memory systems. And it drives such loads at high speeds, using Schottky-clamped transistors. In addition, PNP transistors are used to minimize input loading.

Even though the DS3245 requires only two power supplies — 5 Vdc and 12 Vdc — our design does not compromise the high V_{OH} spec common to other, three-supply circuits.

Further, the design offers memory system protection via an internal fail-safe circuit, which forces all outputs to their low state should the 5-Vdc supply be lost.

Other features of the DS3245 include two common enable inputs, a refresh input, and a clock control input for simplified system designs.

B

A Review of New Products and Literature from National Semiconductor

BACKPLANE, ETC FOR 6800 SYSTEMS

mination impedance.

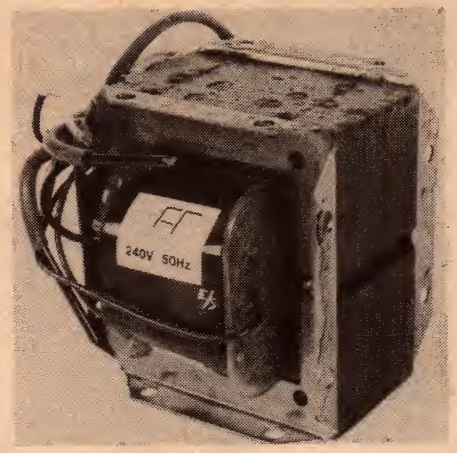
The idea of the 2.6V supply is that this voltage is just above the minimum "logic high" level for TTL type devices. As a result the current drain from the termination supply is very low in the logic high and Tristate (high impedance) conditions, and only significant in the low condition. Average current is therefore quite small.

In addition to the provision for active termination, the JBP680 backplane also provides for up to 8 bypass capacitors on the main 5V supply line, and a bypass capacitor on the + and —12V lines. These features should make it very suitable for expanding D2 kits or similar small Motorola 6800 systems, while retaining maximum performance and reliability.

You can buy the backplane in either bare-PCB or fully wired up versions, the latter with all nine sockets fitted.

To go with the backplane Stewart Electronic Components has available a matching card cage, model JCG680. This measures 356 x 269 x 210mm, and is made from 2.4mm thick aluminium sheet finished in black anodising. It comes with support rails for the backplane, and a perforated steel cover for the power supply compartment at the rear.

The sides of the cage are provided with holes for card guides, which are available separately in pairs.



Steward Electronics' type JDt2 power transformer, which provides 8V at 24A and 2 x 15V at 1.5A.

Also available are a variety of power supplies and supply components. There are four complete power supplies, each of which is available either in free-standing form or in modular form suitable for mounting in the JCG680 cage.

Smallest supply is the JPS001/JPS011, which provides 5V at 5A and +12V at 1A. Then comes the JPS002/JPS012, providing 5V at 10A and +12V at 1A. For bigger systems there is the JPS003A/JPS013A, rated at 5V/24A, +12V/1.5A, —12V/1A and —5V/500mA, or the JPS004/JPS014 rated at 5V/24A, +12V/1.5A and —12V/1.5A. In each case the second type number applies to the bolt-in module version.

Features of all supplies include over voltage crowbar protection, adjustable current limiting, soft-start on the 2.6V termination bias supply rail, and remote sensing capability.

Components available separately include power transformers, reservoir capacitors and power supply PCBs, etc.

Price of the JBP680 backplane in PCB-only form is $39.00, or $103.00 for the fully built-up version. The card cage metalwork is $33.95, plus 50c per pair of card guides.

Prices for the built-up power supplies are $106.07 for the JPS001/011, $176.00 for the JPS002/012, $225.50 for the JPS003A/013A and $220.38 for the JPS004/014. The power transformers range from $7.50 to $28.60, the latter for the JDt2 offering 8V/24A and 2 x 15V/1.5A.

All of the above prices are plus tax, if applicable.

Further information on all of these products is available from Stewart Electronic Components, 33 Sunhill Road, Mt Waverley, Victoria 3149. Telephone (03) 277 0600.

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IQ 120 $1245

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a price/performance breakthrough in professional terminals
All the capabilities of the IQ 120, plus a score of user-oriented features. Screen edit, status/mode conversion, wrap-around insert/delete, reverse video are just a few. Controllable from 16 function keys on the detachable keyboard. Limited availability so order now.

- status/mode indicator line on screen
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- Digital clock.
- 8 bit 2 channel A/D converter & joystick.
- S100 bus signal edge connector.

M110B model $1281.00
Same as above plus an additional 16K of RAM.

M170A $1527.00

- Includes all of M110A model
- black and white TV monitor (24 lines x 64 characters)
- one cassette unit
- power supply box

M170B $1822.00
Same as M170A model plus an additional 16K of RAM.

OPTIONS

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- Colour Graphic (256 x 192 dots) display monitor
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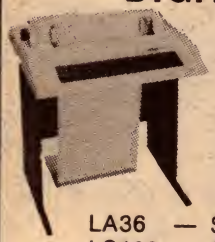
DIGITAL



BRAND NEW LA36 Decwriter II keyboard printer terminal

LA36 — $1625.00
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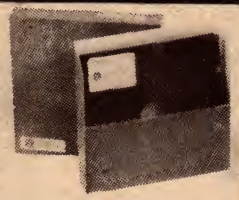

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A low-cost EPROM eraser

Erasing an EPROM is basically quite simple, but some problems can occur. In this article we present details of a simple, economical eraser, as well as some hints on how to use it.

by DAVID EDWARDS

2708 EPROMs are the most commonly available user-programmable and erasable "read-only" memory devices used by hobbyists and small industrial users. Erasure is achieved by irradiating the chip itself, through the window provided, with intense ultra-violet radiation.

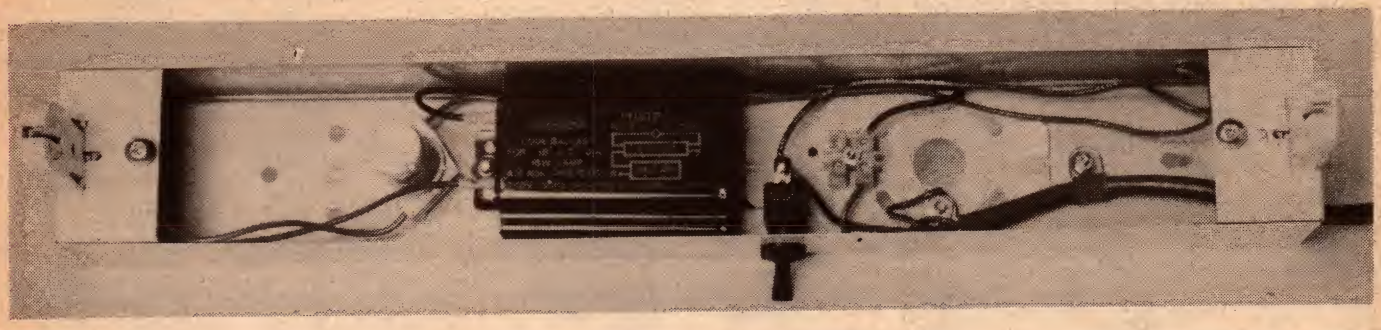
The radiation must have a wavelength of 2537 Angstroms, and the required dosage is 15 watt-seconds per square cm. Commercial erasing devices are available which include suitable light sources and exposure timers, but these are rather expensive, and beyond the financial reach of most enthusiasts.

Fortunately, suitable UV lamps can be purchased locally, and allow a quite practical eraser to be constructed for about $30.00.

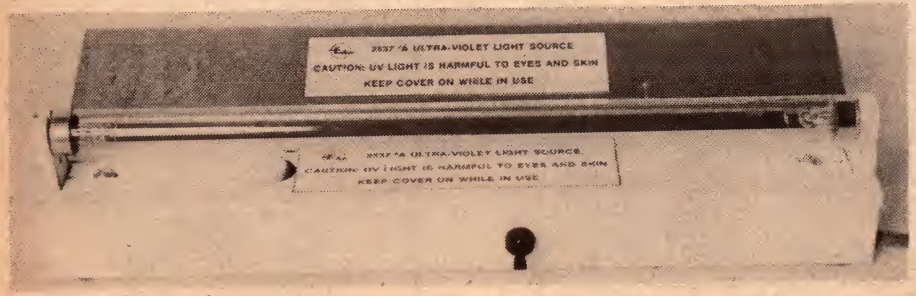
The lamp in question is a Philips type, from their range of germicidal tubular lamps. The model number is TUV 15W (catalogue number 57415 P/40). This is a low pressure mercury vapour lamp, similar to a standard fluorescent lamp, but without a phosphor coating, and using a special glass which transmits the ultra-violet light with low attenuation.

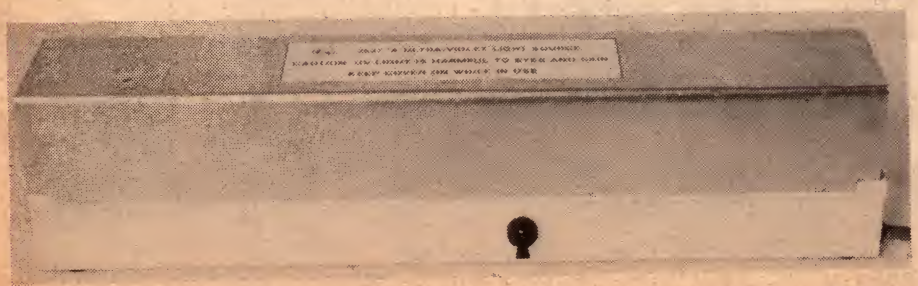
Almost all of the energy from this lamp is concentrated about the requied 2537 Angstrom line. Incidentally extreme caution must be used with this type of lamp, as the light can cause eye and skin diseases.

Order the tubes, along with a



TOP & BELOW: These three views show the UV light source at various stages of assembly. Devices to be erased are placed under the tube for 30 minutes.





The ends of the top cover are bent so that it sits naturally on the batten.

HANDS OFF THE T.V. SET

Video Games

A Major breakthrough in portable electronic fun

It's only natural. Television affects our lives in an extraordinary number of ways. It is today's major communication vehicle with the world. Innovative scientific efforts have expanded the possibilities of the television receiver console. Teletext, home computers, and programmable video games are just some of the more recent examples.

THE VIDEO TRAUMA

Perhaps most obvious has been the use of television receivers for the playing of video or television games. These games which utilised dedicated chips, often caused family frictions during prime time viewing hours as siblings fought to secure the use of the monitor either as a VDU (visual display unit) for game use, or to watch a desired programme on the favourite channel.

THE DISCOVERY

MATTEL Scientists realised the possibilities. Using a combination of available microprocessor technology and special miniature circuits, they were able to develop a sophisticated, challenging, portable video game that did not even need a television set.

THE CHALLENGE

These little microprocessor marvels are technological lightweight you can carry them in your hand, take them out with you to picnics, long car rides, or just sit in the corner while others are watching their favourite television programme.

THE EXCITEMENT

Beat the Clock!
Shift into first gear and you're off. Dodge the oncoming cars or watch out. You've got just ninety-nine seconds to complete four laps of the electronic track. Hear the roar of the crowd — GO!!

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suitable 460mm batten and 15W ballast and starter, from your local electrical retailer. At the time of writing, Circuit Components (A/Asia) Pty Ltd, of 383 Forest Road, Bexley, NSW 2207, have stocks of lamps and suitable battens.

As you can see in the photographs, we were able to use the batten direct, with only minor modifications. We fitted rubber feet to the bottom, and a three-pin mains plug and suitable flex.

In order to minimise the radiation hazard, we fashioned a U-shaped aluminium lid. If desired, this could be hinged to the batten, and a microswitch fitted so that the tube is only energised when the lid is in place.

We made up a suitable warning label, which we fixed to both the batten and the lid. A copy of this label is reproduced with this article, and should be used with any erasor. It can be either copied, or cut out and used directly.

In use, the EPROMs are simply placed on the top of the batten, underneath the tube, and the cover placed over both the tube and the chips. At least 15 devices can be erased at once.

The energy output of the TUV 15W tube is specified as 3.5W and, assuming that the chips are placed 25mm from the centre of the tube, we have calculated the energy intensity at the chip surface as between 1.6 and 5 mW/cm ^{2}, depending on the efficiency of the reflector.

This translates to an exposure time of between 15 and 50 minutes, so a good compromise would be to expose for half an hour. Under-erasing should be avoided, as this may cause problems in programming. Over-erasing is not advisable, but should not cause any problems.

Timing of the exposure is not very critical. You can use either a wristwatch or clock, or a mechanical kitchen timer can be pressed into service.

Finally, we would like to point out that although the TUV 15W tube cannot be used to expose Scotchal light-sensitive aluminium and similar products (the wavelength is too short), suitable 15W actinic tubes to fit the batten can be obtained. This may permit expansion of the uses to which the eraser can be put, and hence offset some of the cost.

CAUTION: UV LIGHT IS HARMFUL TO EYES AND SKIN

2537 °A ULTRA-VIOLET LIGHT SOURCE

KEEP COVER ON WHILE IN USE

PROTECT YOUR EYES: Make two copies of this warning panel and attach them to the batten and to the top cover.

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Fibreglass antenna with exclusive 'Power Coil'. Complete with roof mount base, trunk tip mount, cable & plug. Cat. D-4452
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Connect into antenna lead. By adjusting four knobs virtually all mismatch between antenna and rig can be eliminated.
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The Australian CB SCENE

AT THE CROSSROADS: WHAT'S AHEAD FOR UHF CB?

All the indications are that UHF CB is at the crossroads. Right now, nobody can be quite certain whether it will plod along in a minority role "down under" or head off to a large scale success both here and overseas.

by NEVILLE WILLIAMS

When Philips-TMC took up the challenge of UHF CB a couple of years back, the portents for success were most favourable.

Philips had a development and manufacturing facility dedicated to 2-way radio communication, and considerable experience with professional UHF equipment. It would not be too large a step to divert some of that expertise to the design and production of a mobile UHF transceiver for the proposed 470MHz CB band.

Indeed as the project actually began to take shape, Philips-TMC management saw in it an opportunity to rethink their overall production approach, taking advantage of the potentially greater factory through-put. Automation and other techniques, invoked for a new CB venture, could ultimately find their way into established production lines.

And the Federal Government certainly liked the idea. Largely through neglect in the preceding decade, they had been pressured into legalising CB on 27MHz, thereby inheriting the consequent problems already familiar on the American scene. They were nothing, if not willing, to add the 470MHz option and to spell out regulations which would make it the only legal CB band after June 1982.

Twelve months ago, the planning became a reality, with the Philips-TMC FM320 transceiver on sale at just over $300 per unit, backed by guarantees and a provisional national network of service facilities.

To those inclined to be cynical about local production efforts, release of the FM320, more or less on schedule, was notable in itself. Even more so was the fact that the selling price was not too far removed from the original prediction of: "around $300, complete with antenna". This, at a time when most other prices were tending to skyrocket!

It led quite a few to speculate as to how Philips-TMC could produce a completely new and unique transceiver, with up-to-the-minute facilities and sell it for that kind of money. Having in mind the development costs, they surely could not be making any money on it!

I have every reason to believe that they weren't, nor did they expect to in the short term. The price had to be low enough to attract the up-market buyers who would inevitably become disillusioned with conditions on 27MHz, even assuming the best available SSB equipment. The ultimate reward would come from economies of scale as production built up.

Over and above that, Philips worldwide had a stake in the venture. If their team in Melbourne — design leaders in this field — could demonstrate a production-proven UHF CB transceiver, it would give the whole organisation an advantage in pioneering UHF CB in other countries.

Unfortunately, as we said at the outset, just when UHF and the FM320 should be on the high road to success, it is hesitating at the crossroads.

Why?

The most significant factor is what has happened in the meantime to 27MHz CB, which the FM320 was designed to supersede.

At the time when the FM320 was under development, enthusiasm in Australia for CB-style communication was unbounded. It was the "in" thing, particularly at a youth and young family level. Illegal or not, suppliers couldn't get stocks fast enough to meet the demand.

One did not need a crystal ball to foresee that the channels would become hopelessly choked; that those who wanted deliberate, rather than casual, communication would look around for an alternative that offered predictable performance, even if it meant a modest increase in cost over then current up-market 27MHz equipment.

In the December '77 issue, carrying

Designed expressly to meet specifications laid down by the Australian P&T Department, this Midland prototype model 13-405 passed readily through local acceptance tests. Whether it is ever launched on the market depends on Dick Smith Electronics — or somebody else — signing a quantity order that will get production under way.

pictures of the first production batch of FM320s, Dick Smith Electronics was offering their "Australianised" 27MHz "Scorpian" SSB unit for $299.50 and their "Hornet" SSB for $259.50. EMI had just announced their "Roadhound" AM/SSB for $239, while the "Electrophone" from the Radio Parts Group was listed at $249.63.

Against these figures, $300-plus was indeed a modest increase.

But, shortly afterwards, the bottom fell right out of 27MHz CB, due in part to the overcrowding that had been predicted. But the position was aggravated by bad publicity, both local and overseas, which discredited CB and alienated many of the potential up-market buyers. Instead of turning from 27MHz to UHF, they simply rejected CB altogether!

The nett effect on the CB market was disastrous, importers found themselves with tens of thousands of 27MHz transceivers in stock, in bond or on the water, which they had no hope of clearing in the normal way. So, during 1978, prices began progressively to collapse.

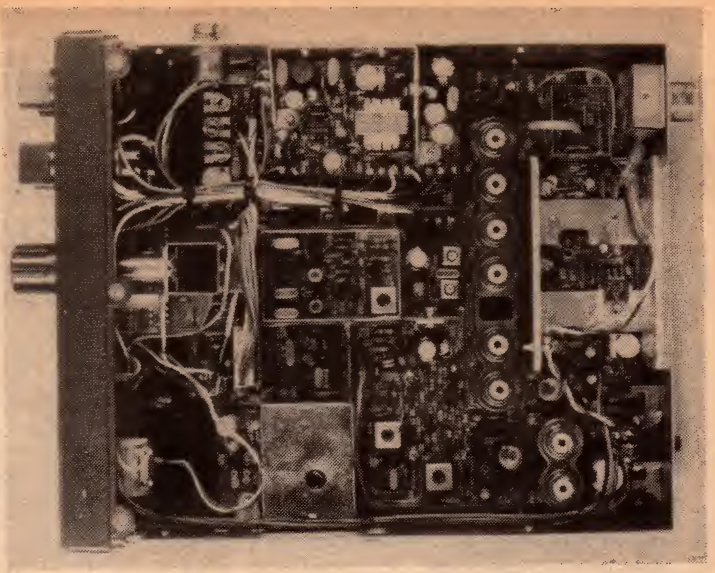
Profit margins were cut drastically, then eliminated altogether as marketers sought merely a recovery of capital. They even began to sell below cost rather than be completely ruined by dead stock and by interest and other changes. In the extreme, CB gear changed hands for as little as half the logical selling price and the message around the industry was: "CB has had it!"

In the event, Philips-TMC found themselves with an industry and a marketplace that was thoroughly "browned off", and trying to sell against a product that was in gross over-supply both here and overseas. Against the ruling clearance prices, the FM320 CB now looked "too expensive".

Faced with a drastic slow-down in sales, Philips appear to have switched their selling emphasis right away from the once magic letters "CB". Indeed, at the most recent Bathurst 1000 car races, the array of FM320 advertising signs had a quite different emphasis: "Personalised 2-way Radio".

In a way, instead of feeding a product into a capacious CB pipeline, the company now faces the task of establishing a new market, still nominally CB, but in reality "personalised 2-way radio". They have the lonely job of re-enthusing all those buyers who thought it would be nice to have 2-way radio but who could not justify the expense and hassle of a formal commercial system.

Because it is a lonely job, Philips would obviously welcome some com-



The Midland 13-405 UHF CB transceiver gives the impression that, with a minimum of further development, it could go straight into production. Perhaps Midland also have an eye on UHF CB in countries other than Australia!

petition and additional promotion for the 470MHz band. In fact, their wish seemed to have been met when Dick Smith Electronics received a prototype of a 40-channel Midland transceiver, developed expressly for the Australian UHF CB band. Provisional pricing indicated that, allowing for duty, etc, it could be marketed at about the same recommended retail figure as the FM320.

It arrived, complete with specifications and test data and, when submitted to the North Sydney Testing Laboratory of the P&T Department, it apparently met all type approval requirements without difficulty.

Dick Smith claims that, in important respects, it betters the performance and specifications, of the FM320 and, certainly, when we opened it up in our own workshop, there was little to suggest that it was a prototype. Presumably, Midland could put it into production with a minimum of delay.

However, the word seemed to be that Dick Smith is unwilling to place an order for what would have to be a substantial production batch. He still has a lot of capital tied up in unsold 27MHz equipment and is naturally hesitant to make a further substantial investment in what may turn out to be a rather slow moving line.

"After all," says Dick, "we do sell the FM320, and it's there for anyone who wants the relative privacy of UHF CB.

"I just don't accept that splitting the market at this stage would improve matters for anybody."

In the meantime, what do Philips say?

Officially, very little but, from "unofficial" conversations I gained firm assurance on two points:

- There was no foundation whatever for the rumour that Philips-TMC intend to abandon the FM320 and UHF CB. Production will continue at whatever rate is necessary to meet the market demand.
- There is no present intention to increase the recommended retail price for the FM320. Philips will simply spread recovery of development costs over a longer period.

In fact, the emphasis was on the long-term view. Philips are certain that the UHF band will experience increasing usage as citizens realise its very real advantages, and as they — and the industry — get over the mental and financial blocks created by 27MHz CB during 1978. And, of course, interesting developments on UHF still lie ahead in America and on the continent.

But the hiatus will exacerbate the Federal Government's problem with the existing 27MHz CB band. Their stated and still official policy is to withdraw all licences for 27MHz CB on July 1, 1982. It always would have been a tough decision to implement but, by setting the cut-off date five years ahead, there was the hope that imports of 27MHz equipment would have dried up spontaneously and that the UHF alternative would have become entrenched and popular.

But we enter 1979 with importers still holding large unsold stocks of 27MHz gear and with UHF CB in the doldrums. The Government may not find too many supporters as the critical date approaches — rather a quarter million 27-meggers screaming "leave us alone".

Other complications for the Government include whatever may emerge from WARC '79 and their undertaking to amateurs that their access to the 27MHz band would be restored on July 1, 1982.

Significantly, it was a member of Parliament, Mr David Jull, who advised amateurs at the WIA Queensland Division convention to keep pressure on the Government, in case it should feel tempted to back off from the earlier decision.

One would feel really sorry for the parliamentarians if they weren't so well paid!

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Kit AT468 . . . . . $75.00
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This quality kit uses microphone input instead of connection to the audio output. 1500w max.

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540-1600 KHz receiver complete with ferrite coil antenna.

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1 amp well-regulated supply for professional use. Complete with box and transformer.

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AMATEUR RADIO

by Pierce Healy, VK2APQ

Sydney Science Museum puts amateur station on display

Thanks to the generosity of a local electronics firm, the Sydney Museum of Applied Arts and Sciences now has a working amateur radio station on display. To be manned by volunteer operators, it should provide an excellent means of introducing amateur radio to the public.

The Sydney Museum of Applied Arts and Sciences amateur radio station, VK2BQK, will be officially opened within the next few weeks. Initial checks and operational tests conducted since early December, 1978, have been satisfactory and it is anticipated that the station will become known world wide.

Current arrangements are for the station to operate during museum hours each Saturday and Sunday. A roster of operators has been prepared by the NSW Division of the WIA, and any amateur (whether a WIA member or not) is invited to add his name to this roster. As well as helping the amateur radio cause, he will have the opportunity to operate some very modern equipment in a very pleasant environment.

In addition to the station equipment, a large area has been set aside for a static display of vintage amateur radio equipment, historical documents and photographs relating to amateur radio, and the progress of radio communication over the years.

The station equipment consists of an FT101E HF transceiver, a FT7 HF transceiver, FT227R VHF FM transceiver, FRG7 receiver, SWR meter and amateur station QTR24 clock. The HF antenna is a Hustler type 4BTV with an RM80 attachment. The VHF antenna is a Hustler type G6-144.

The equipment was presented to the museum by the Dick Smith Electronics Group, and is under the direction of Mr Jeff Sergel, VK2BQI, curator of the electronics section of the museum.

It is also desirable that the station is manned during weekday musueum hours, particularly during special visits by high school students. In this regard, any amateur who wishes to assist and obtain authority to operate the station may contact Mr Jeff Sergel at the museum during office hours or advise the Secretary, NSW division WIA, 14 Atchison Street, Crows Nest 2065.

This is an excellent opportunity to assist in publicising amateur radio and the museum authorities must be praised for their initiative and interest in setting up the station and static displays as a permanent feature for public inspection.

The amatuer radio station, VK2BQK, at the Sydney Museum of Applied Arts & Sicences. Curator, Mr Jeff Sergel, VK2BQI, is shown operating the FT101E transceiver, with the SWR meter above it and the FRG-7 receiver to the left. The VHF transceiver is hidden by the operator.

Amateurs are urged to support the project. Some 325,000 people visit the museum each year and, of these, a significant percentage would be potential amateurs. The display will be one of the best opportunities amateurs have had for a long time to recruit new members, and to educate the public generally regarding their hobby.

ITU NEWS

On November 29, 1978, I (VK2APQ) had the pleasure to attend a press conference given by Mr Richard Butler, Deputy Secretary General of the International Telecommunication Union, at the United Nations Information Centre, Sydney. Mr Butler presented a paper entitled — "The Changing Communication Environment" — which was illustrated by colour slides.

The address covered man's methods of achieving international communication from the time of Julius Reuter's carrier pidgeons to the present day multi-channel microwave, ocean cable, and satellite systems. It made the point that Reuter had used carrier pidgeons to bridge gaps in the European telegraph system, caused by lack of international agreement on cross-border operation.

Obvious facets of modern communication systems — telephone, radio, television and satellites were referred to; from simple person to person telephone systems to complex satellites providing international television services and linking computer systems. Also mentioned and illustrated were the not so obvious navigational and meteorological telecommunication systems, and the even less obvious earth exploration service satellite.

These examples emphasised the need for highest international understanding and co-operation at grass roots level in order to obtain the greatest benefit from these spheres of modern technology.

Radio clubs and other organisations, as well as individual amateur operators, are cordially invited to submit news and notes of their activities for inclusion in these columns. Photographs will be published when of sufficient general interest, and where space permits. All material should be sent to Pierce Healy at 69 Taylor Street, Bankstown 2200.

AMATEUR RADIO

Arising from questions after the address, amateur radio was discussed. Mr Butler spoke highly of the amateur service, referring in particular to the attitude of several European countries and their use of the OSCAR satellites for educational purposes.

Even the European fox hunting championships were mentioned; whereupon I was asked to explain what fox hunting, in amateur radio terms, really was (i.e., locating an expertly hidden transmitter within a given, or shortest possible, time).

After the formal meeting Mr Butler unofficially answered a number of questions I put to him regarding the future of amateur radio. It would be ill of me to relate possibilities, good or otherwise, which have been unofficially mentioned as a possible outcome of WARC 79. Suffice it to say I was pleased to hear that there is, among officials of the ITU, a very high regard for the service amatuers can give to the community.

However, there are many problems to be solved which will need co-operation and understanding at international level. It is evident that a great deal depends on how well amatuers, through their national societies, influence and gain the co-operation of their local administrations to realise the real need for a flourishing amateur radio service.

The final paragraph of Mr Butler's address gives a forecast of the prospects for telecommunication.

"What is being shaped now for the next century goes way beyond historical issues of traffic handling, information transfer and data processing or even transmission links. In effect, what is being shaped is the nucleus of a dynamic and potentially very powerful communication system for all. It is no longer simply a telecommunication system."

SPECIAL PREPARATORY MEETING

Some 750 scientists and engineers from 87 countries took part in a Special Preparatory Meeting in Geneva from October 23, to November 17, 1978. Over 400 documents were studied.

A 600-page report prepared by the SPM will provide the technical information likely to be needed by the World Administrative Radio Conference (WARC 79).

The results could lead the WARC to make considerable modifications to the spectrum allocation up to 300GHz.

The report is being distributed as a document for WARC 79. It cannot be bought and is not available to the public. (ITU press release 78/40 Nov 24, 1978.)

INTERNATIONAL AMATEUR RADIO UNION

The fourth conference of the IARU Region III Association was held in Bangkok, Thailand, on October 7, 8, 9, 1978. Member societies represented were — ARRL (USA Pacific Territories); HARTS (Hong Kong); JARL (Japan); MARTS (Malaysia); Nzart (New Zealand); PARA (Philippines); RAST (Thailand); SARTS (Singapore) and WIA (Australia).

Also present were Vic Clarke, W4KFC, president of Region II IARU (deputising for Noel Eaton, VE3CJ, president IARU), and the four directors of the Region III association.

The conference was formerly opened by the Deputy Undersecretary, Ministry of Communications of the Royal Thai Government, Sriphoom Suknetr, HS1SS, who assured delegates that the claims of the amatuer service for WARC 79 would be carefully borne in mind by the government of Thailand.

The conference appointed the president of the host society RAST, Kamchai Chotikul, HS1WR as honorary chairman of the conference and Fred Laun, HA1ABD, working chairman. David Rankin, 9V1RH, secretary of the Region III Association, was appointed as assistant secretary.

Considerable time was devoted to WARC 79, each society reporting on its own preparations. Several policies adopted at the Hong Kong Region III Association conference were varied to conform to WARC policies adopted by the Region I and Region II 1978 conferences. In particular, a policy, not to seek change to Article 41 of the ITU Regulations, was confirmed. That Article deals with the amateur service. The conference also adopted a paper relating to the Amateur Satellite Service submitted by Shigetake Mirimoto, JA1NET.

The IARU observer team for WARC 79 was outlined by Dick Baldwin, W1RU, secretary of IARU. The team includes Michael Owen, VK3KI, and arrangements have been made for Tom Clarkson, ZL1AZ, to participate as a special advisor to the IARU president. In addition, Dick indicated that IARU president Noel Eaton, VE3CJ, wished the Region III Association to provide a member of the team from Asia. Accordingly the conference recommended Shigetake Mirimoto, JA1NET and David Rankin 9V1RH/VK3QV, who would each be available for about half of the 10-week period of WARC.

The PARA delegate reported that J. J. Tupaz Jr, DU1JJT will be included in the Republic of the Philippines panel at WARC 79 as official delegate for the amatuer service. DU1JJT was chairman of the amateur service study group for the preparation of the Philippine paper for WARC 79.

A grant to meet the expenses of JA1NET and 9V1RH/VK3QV as members of the IARU observer team was announced by Shozo Hara, JA1AN, president of JARL. Additional funds were also pledged by PARA and the WIA for the defence of amateur frequencies at WARC 79.

Other business included several submissions on the role of amateur radio in promoting technical education and how this could be extended. Submissions also advocated the need to emphasise self-training as a justification for the conditions being sought at WARC 79.

The next Region III Association conference will be in Manila in 1982, though the directors were asked to meet not later than May 1980 to evaluate the results of WARC and then advise member societies of the effect of those results.

(Acknowledgement to David Rankin, Secretary Region III Association for the report from which the above extract was taken.)

WIA NEWS

After some considerable time the P&T Department has produced a draft revision of the Handbook for Operators of Radio Stations in the Amateur Service. A draft copy has been given to WIA for comment.

The new handbook has taken into account all the concessions won by the WIA since the previous edition was printed in 1967. But it also contains a number of new provisions which will require considerable investigation by the executive of the WIA, and arrangements have been made towards that end.

A number of new definitions have been introduced as well as new material, covering examinations and provisions for club station licenses. Repeater station conditions have been set out in full. Broadcasts from club stations, third party traffic, mobile operation, emergency networks and training exercises are included with new amendments.

There are many more amendments and new material in the draft and the WIA executive, on receipt of their copy in November 1978, asked the Department for an extension of three months so that the contents and implications could be given proper consideration.

WARC 79 DONATIONS

The WIA circular to non-members inviting donations towards expenses of Region III representation at WARC 79 has brought a very pleasing response, and many of the donors wish to join the Institute. However, some 200 letters to non-members have been returned: (address unknown, left address, etc). An adverse effect of this is that the 1979 call book information will be inaccurate as far as these people are concerned unless they notify the P&T Department of their current address.

(Note: Regulations numbered 87, 88, 89 in the current handbook relates to change of address of an amateur station.)

AMATEUR RADIO

CENTRAL COAST FIELD DAY

The 22nd annual field day of the Central Coast Amateur Radio Club will be held on Sunday, February 18, 1979 at the Showground, Showground Road, Gosford, NSW. All amateurs, their families, and friends are invited to attend.

PROGRAM:

8 am-12 noon: Registration — Men $4; Women $2; Children 16 years and younger $1. This includes morning and afternoon tea, outings, and entry in events. Pensioner concession is 50% on production of pensioner card.

Special note: Lunch will not be provided by the club. A takeaway food bar will be open in the showground from 10 am to 3 pm.

Tea and coffee will be available from 8 am to 5 pm in the dining room, free to anyone displaying their registration card.

8.30 am-9.00 am: Mobile scramble in two sections (a) HF; (b) VHF. Rules: No operation in the showground or 1km radius. VHF nets 1 point per contact. VHF tunable CW, AM or SSB 4 points per contact. No operation through Gosford repeaters or within 0.5km of Gosford repeater sites. Log extract to be passed to "event recorder" before 10 am showing time of each contact, station worked, frequency mode, serial numbers in full and points claimed. In the event of tied scores neatness of log will count.

9 am: Ferry trip tickets on sale at "ticket sales" near announcer. The fare is subsidised, field day registration card must be shown. Sale of ferry tickets ceases at 12 noon. Eighty tickets only available, including children.

9 am-10 am: Bookings for equipment workshop in Dwyer Pavilion.

All items for the disposal market must be in before 9.30 am.

9.30 am: Register in Showground Road opposite to Dwyer Pavilion for 10 metre and two metre fox hunts. Registration card required.

9.45 am-10.30 am: Mobile/pedestrian fox hunt. 24.45MHz AM and 146MHz FM direction finding event. Hand held sniffer receivers will be required for location of transmitting antenna in addition to normal vehicular DF equipment. The transmitter antennas must not be disturbed.

10 am: Food bars open. Equipment workshop opens. Disposal market opens.

10 am-10.15am: Junior 2 metre AM pedestrian fox hunt for 16 year olds and younger. Frequency between 144.4MHz and 144.6MHz.

10 am-10.30 am: Children's events — races, etc.

10.30 am: Quiz sheets available — return before 1.30 pm.

11 am-11.15 am: 2 metre pedestrian fox hunt. Frequency Between 144.4MHz and 144.6MHz. AM.

11 am-11.30 am: VK2 division news broadcst from VK2AFY. Broadcast to be televised on ATV.

11.30-12 noon: Children's events.

11.45-12 noon: 2 metre pedestrian fox hunt. Frequency between 144.4MHz and 144.6MHz AM.

12 noon-1 pm: Lunch break.

12.15 pm-12.30 pm: 2 metre AM pedestrian fox hunt.

12.30 pm: Departure time for ferry trip commencing at 1 pm. Transport to wharf by private cars.

1.15 pm: Departure time for Reptile Park outing.

1.20 pm: Register for 10 metre and 2 metre fox hunt.

1.30 pm: Closing time for return of quiz sheets, late entries will not be accepted.

1.30 pm-3.30 pm: Mobile/pedestrian 10 metre and 2 metre fox hunt direction finding event on 28.45MHz and 146MHz. There will be a transmitter on each frequency at two sites. A different audio tone for each site; one site will transmit tone at 30 seconds on and 30 seconds off. The other 40 seconds on and 40 seconds off. Both sites must be found. Hand held sniffer receiver will be required for location of transmitting antenna in addition to normal vehicular DF equipment. Transmitting antenna must not be disturbed.

2 pm-2.45 pm: Junior, 16 years or younger, 2 metre AM fox hunt. Frequency between 144.4MHz and 144.6MHz.

3 pm: Equipment workshop closes.

4.15 pm: Drawing of lucky numbers. If leaving early register your numbers at field day management table.

Prize presentation — advise if leaving early so as to arrange delivery of prizes.

Parking: Off street in showground, please observe directions.

Trains: From Newcastle 9.07 am and from Sydney 8.58 am and 9.52 am will be met at Gosford and transport provided to showground from Gosford railway station. For return transport in the afternoon contact the field day announcer one hour before departure time of train.

If it rains? There is plenty of shelter in the showground.

Bring your QSL card for calls present board.

A condition of entry to the showground is that there be no transmitting within the showground and the request is made that no transmitting take place within 1km of the showground.

Disposals: Items for disposal must be booked in before 9.30 am on the field day. Cataloging forms and lot numbers must be obtained in advance from Bill Smith, VK2TS, RMB 4525, Gosford 2250, or phone 043 74 1207 after hours for forms and lot numbers.

AMATEUR RADIO

A commission will be charged on all sales. Lot numbers and forms will also be available at the showground on Saturday afternoon, February 17, 1979.

Any telephone enquiries concerning the field day may be made to Ross Mudie, VK2ZRQ on 02 663 0141 between 8 am and 3 pm weekdays only.

RADIO CLUB NEWS

Here are two additions for your radio club director (see December 1978 issue).

Club name: North Western Branch Tasmanian Division WIA.

Club call sign: Repeater VK7RNW.

Net frequency: FM channel 40 and channel 3 repeater VK7RNW.

Contact: Secretary, PO Box 1010, Launceston, Tasmania 7250.

Club name: Geelong Radio and Electronics Society.

Club call sign: VK3ANR.

Net frequency: Nil.

Contact: Secretary, GRES, VK3ANR, PO Box 962, Geelong 3220, Victoria.

GEELONG RADIO & ELECTRONICS SOCIETY: Society activities have been stapped up recently with the formation of RF and AF groups. New test equipment for members include a CRO, signal generator, GDO and some general usage tools.

A printed board workshop using presensitised board is achieving excellent results. Classes for AOCP; AOLCP and AONCP amateur licence examinations are held free of charge to members on Mondays at 7.30 pm and syllabus meetings on Thursday at 8.00 pm.

Visitors are welcome at the club rooms on Breakwater Road, Belmont Common, Geelong, Victoria.

NORTH WESTERN BRANCH TASMANIAN DIVISION WIA: Meetings are held in Lakins Hall, Ulverstone on the second Tuesday of each month at 8.00 pm.

When travelling through northern Tasmania on holidays, information can be obtained through the Channel 3 repeater.

ILLAWARRA AMATEUR RADIO SOCIETY: A meeting of the University of Wollongong staff, attended by Lyle Patison, VK2ALU, affirmed that the dish antenna should be shifted to the new site.

A secure building would be erected next to the antenna by the university authorities and the moonbounce project group would only have to install the equipment, associated wiring, and cables.

An experimental dual band disc feed for 432MHz and 1296MHz is being made and the CSIRO will test the system on their antenna test range to find out if the 432MHz radiation is affected by the 1296MHz components.

The School of General Studies at Wollongong Technical College is conducting an approved course in electronics, which includes all the information and training needed for novice, limited or full amateur licence.

Enrolments to be made on the first night of the course, Friday, February 16, 1979, at Room 213, Mathews Building, commencing at 6.00 pm.

For further details contact — Brian Wade, VK2AXI. Telephone after hours (042) 84 1381.

DARLING DOWNS RADIO CLUB: As from November 2, 1978, the club's repeater, VK4RDD, formerly on channel 4/6800, has operated on channel 10/7100 (147.700MHz in and 147.100MHz out.

The change was made to eliminate inference from and to adjancent repeaters on the same channel, viz, Bundaberg and Lismore. Operators in some locations could trigger two and sometimes all three repeaters.

Further club details from the secretary, G. J. Pennycuick, VK4AGP, 38 Wentworth St, Toowoomba 4350.

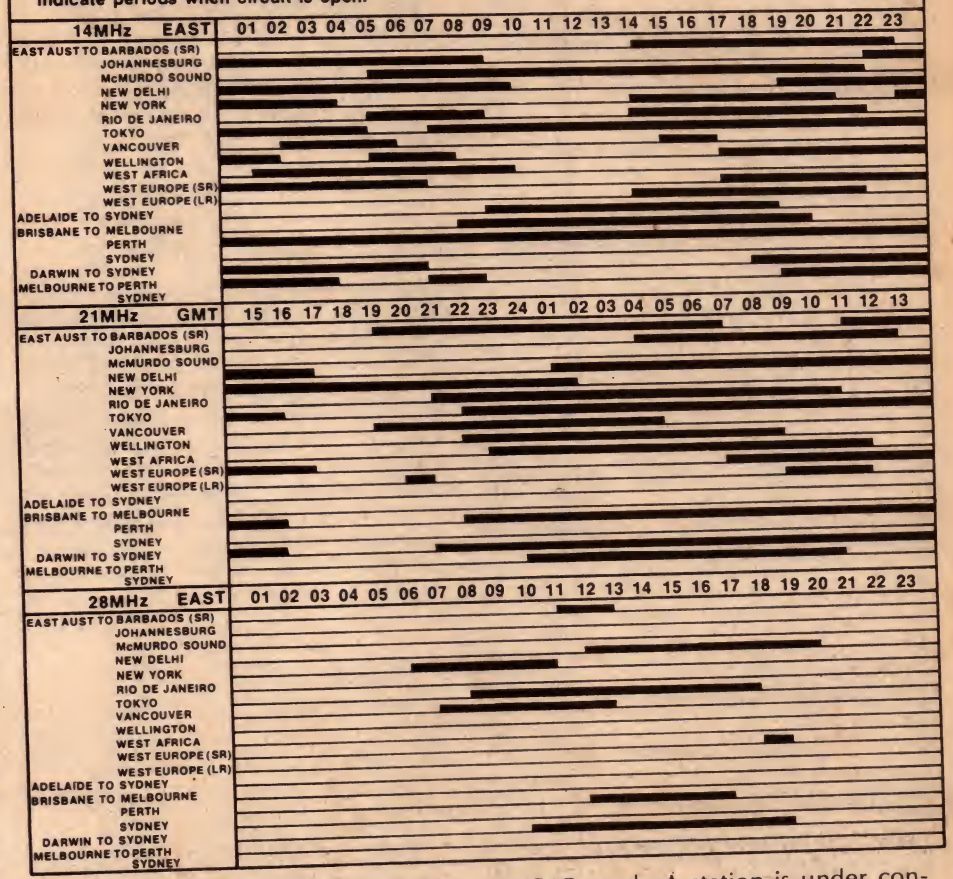
WOOMERA AMATEUR RADIO CLUB: About half of this club's members are Americans associated with the Woomera complex. The club is equipped with a three element HF beam, an 80 metre inverted "V", and an OSCAR mode A station is under construction.

The club meets every Wednesday night at 7.30. It can be heard on 80 metres on most Wednesday nights and at least two members monitor the Port Pirie repeater on channel 2.

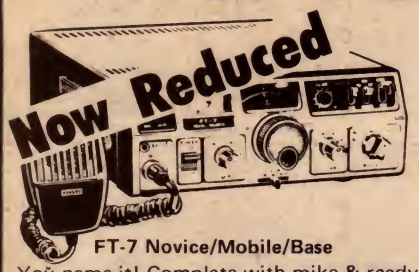
Further details from Andrew Squires, VK5ZWO, F100 Carriwan St, Woomera 5720.

IONOSPHERIC PREDICTIONS FOR FEBRUARY

Reproduced below are radio propagation graphs based on information supplied by the Ionospheric Prediction Service Division of the Department of Science. The graphs are based on the limits set by the MUF (Maximum Usable Frequency) and the ALF (Absorption Limiting Frequency). Black bands indicate periods when circuit is open. 2.79



WE'VE GOT THE GEAR



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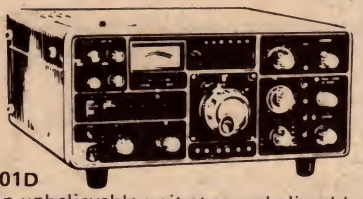

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Take the hassle out of satellite work. Complete kit for both OSCAR 7 and 8 — full instructions. **Cat. K-3480**
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Two items to assist the novice candidate

LEARNING MORSE CODE, by R. Black, B.A., VK2YA. Published by WIA (NSW) Education Service. Soft covers, 32 pages 200mm x 260mm, mainly text but a few illustrations. For use with two C-60 tape cassettes. Price for book and cassettes, $6.50.

Rex Black, the author of this course, has had many years experience teaching Morse code to army, air force and amateur operators, and he has sought to bring the benefit of this experience to the presence course. He has also taken into account the fact that amateur candidates come from a wide variety of backgrounds, and have widely varying aptitudes for learning code, unlike the selected students at commercial or military level.

The first few pages of the book are devoted to the background of Morse code, the examination requirements, study techniques, slow Morse transmissions, etc, plus a certain amount of "salesmanship" aimed at convincing the student that learning Morse is fun!

The main section consists of instructions on how to follow the course, plus practice exercises to be used in conjunction with the tapes. The course is graded from the simplest symbols (all dits) to the progressively more complex ones, with a strict routine whereby the student does not progress until each stage has been mastered.

The final section is devoted to sending; the type of key, how to hold it, wrist action, etc, plus several audio oscillator circuits. There is also a list of "Q" codes.

The tapes are well recorded, with verbal instructions accompanying the Morse symbols. They are designed to take the student to the point where he can indulge in conventional practice to gain speed and confidence.

In summary, a well thought out course which should provide an excellent starting point for any candidate. And, at the price, extremely good value. (PGW)

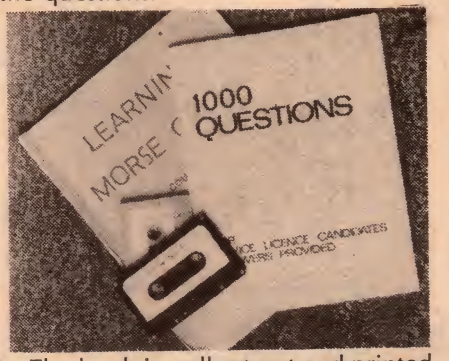
1000 QUESTIONS FOR NOVICE LICENCE CANDIDATES, by K. Hargraves, VK2AKH, D. Wilson, VK2ZCA/NMW, and R. Black, VK2YA. Published by the WIA (NSW) Education Service. Soft Covers, 109 pages, 175mm x 240mm, mainly text. Price, $3.00 posted.

This book is also part of the study kit referred to in the previous review. As its name implies it is a series of 1000 questions aimed at testing a novice candidate's progress and at presenting him with the kind of questions he will encounter in a real exam.

It is emphasised that these are not the actual questions which will be asked, but are of the same standard, and presented in the same style, as in the actual exam. (There is no point in a student trying to memorise the questions, even assuming he could do so!)

It should also be realised that the book is not, in itself, an instructional text; the student will learn little from it — directly — in the technical sense. What he will learn is, firstly, what he does not know and, as a logical step from this, will be encouraged to refer to the appropriate texts until he understands that subject.

The questions are divided into 17 subject headings, ranging from electrical laws to regulations, and this classification should further assist the student to pinpoint his weak subjects. A brief appendix lists the answers to all the questions.



The book is well set out and printed, and obviously represents a very considerable effort on the part of the voluntary authors and others who assist them. As might be expected in a list of this size, it is possible to find a few cases where some suggested answers carry a degree of ambiguity. However, this should not detract from the book's purpose; to make the student aware of his weak points and the need to study them.

The book should also prove invaluable to instructors, providing an almost unlimited supply of typical questions for use in trial examinations.

At the other extreme, the isolated student, who must fend for himself, will find it an invaluable guide to what he needs to study.

In short, a book like this is a "must" for any prospective candidate and, equally important, it is very good value for a very modest price. (PGW)

SHORTWAVE SCENE

by Arthur Cushen, MBE

New TWR gospel station proves popular

The Trans World Radio organisation signed an agreement in 1975 with the Sri Lanka Broadcasting Corporation and obtained a franchise to operate a station which would be jointly programmed by the two organisations. The new 400kW transmitter is broadcasting programs from the Sri Lanka Broadcasting Corporation 7am-7pm local, and programs of Trans World Radio throughout the night. The transmitting towers are each 190 metres high, and the signals are beamed to New Delhi in India some 2000km away.

The transmitters are located 104km north of Colombo on the west side of the island, and operate on the medium-wave frequency of 891kHz. The transmissions are carried in eight Asian languages but this is expected to be expanded following the opening of recording studios in Bangladesh.

At present, studios in India and Pakistan supply the Colombo office with transcribed programs. Trans World Radio, which had its beginning in Tangier in 1954 (when we verified WTAN), is now broadcasting from all continents with stations in Monaco, Cyprus, Swaziland, Guam and Bonaire.

RADIO AGRICULTURA

Radio Agricultura at Santiago, Chile, is providing good reception on 9630kHz from opening at 0900GMT. Jack Buckley of Sydney, NSW, has noted this signal and the earlier sign-on time due to the fact that Chile is now on summer time. The station formerly opened at 1000GMT. There is some interference from Radio Nederland up to 0920GMT when for 10 minutes the broadcast is clearly received, but at 0930GMT Radio Sweden opens on the channel and again causes interference.

Radio Agricultura opens with a march and full identification in Spanish which includes information of other stations in the network. A news bulletin follows and then a program on agriculture for Chilean farmers. Some weeks ago the station moved temporarily to 9670kHz, but has now returned to its assigned frequency of 9630kHz.

WORLD RADIO CLUB

The popular BBC World Radio Club program, which includes information for the short-wave listener, has been retimed for the broadcast to the Pacific. The program is now heard on Sundays at 0745GMT on 7150, 9640 and 11955kHz. The World Radio Club program is repeated on Monday at 1115, Tuesday at 2100 and Wednesday at 2315GMT.

World Radio Club is written for the short-wave listener in a language that is not too technical, so that it can be understood by beginners when the session is dealing with electronics. A feature of the 15 minute program is the "Shortwave News", which is generally supplied by the BBC Monitoring Service.

BRAZILIAN EXPANSION

Brazil is fast becoming one of the most radio intensive countries in the world, with numerous new stations being reported.

The Communications Ministry has opened bids for the installation of 13 new radio stations in the country: this includes three short-wave, five medium-wave and one tropical band station.

INCREASED SW COVERAGE

The recent frequency changes for medium-wave stations in Europe, Africa, Asia and the Pacific has resulted in 9kHz station separation. Already, in Europe, the frequency moves have resulted in poorer coverage for some stations. This has been true in Germany where several of the main stations which have short-wave re-broadcasts of their programs are stepping up the power on short-wave to compensate for their loss of medium-wave coverage.

A German newspaper report reproduced by the BBC Monitoring Service states that the Bayerrischer Rundfunk has had to make the biggest sacrifice of any German station with its move from 1602 to 801kHz. To compensate for the loss of audience abroad, plans are underway to considerably increase the power of the short-wave relay of Bayerrischer Rundfunk on 6085kHz.

Radio Bremen on 619kHz also relays a medium-wave program and this is broadcast 1000-1700 Sunday to Friday and from 0800-1100 on Saturdays. According to a letter from the station, the balance of the transmissions are a relay of Sender Freies Berlin.

LATIN AMERICAN NEWS

BONAIRE: Trans World Radio at Bonaire is using the new frequency of 9610kHz for the broadcast to Europe and Africa 0335-0500GMT. This gospel service is in several languages and was heard recently on 9535kHz, but on this channel suffered interference from Radio Canada International broadcasting to the United States and Central America. Trans World Radio Bonaire changed frequency to 9610kHz in mid December, and this new channel is providing much better reception.

COSTA RICA: Radio Casino, Station TIQ has made a frequency change from 5955 to 5960kHz. This station has been heard for many years but with the powerful Radio Nicaragua now using 5955kHz, TIQ was forced to make the frequency change. Our reception has been after 1100GMT but there has been some interference from Radio Moscow.

ECUADOR: HCJB in Quito has made a frequency change for the afternoon transmission to North America from 0030 to 0700GMT. The frequency of 9745kHz is now used for this broadcast, this outlet replacing 9560kHz which was suffering interference.

HAITI: Radio Nationale have been heard on 6156kHz at 1030GMT, according to Jack Jones in "Tropical DX". The station also announces as Radio Citadelle and has been heard as early as 1000GMT.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All times are GMT. Add 8 hours for WAST, 10 hours for EAST and 12 hours for NZT. In areas observing daylight time it is necessary to add one hour.

SHORTWAVE SCENE

TWR SWAZILAND

Trans World Radio Manzini has increased its English transmissions with a broadcast to Central Africa 1630-1800GMT. Two frequencies — 9720 and 11910kHz — are used, according to a report from Colin Miller in Johannesburg. The new schedule received from the station, which confirmed our reception of 4760 and 4790kHz, indicates that English broadcasts are 0430-0630 on 3275 and 9530; 0635-0835 on 5055 and 11910; 1200-1415 on 9530; and 1800-1915GMT on 7280kHz. The address of the station is Trans World Radio, PO Box 64, Manzini, Swaziland.

CHINA ENCOURAGES LISTENING

China has lifted restrictions on listening to overseas broadcasts. Several months ago the Voice of America studios in Washington received only a trickle of mail — 5 or 6 letters a month — from listeners inside China. Today the mail is between 50 and 60 letters a day as Chinese students are encouraged to listen to the Voice of America in order to improve their English and to get a better knowledge of world events.

The Voice of America broadcasts news in English at slow speed and uses a standard vocabulary of only 1000 words. For this reason, the program is particularly appreciated by those learning English in many parts of the world. The increasing numbers of Chinese listeners listening to programs from outside their own country will do much to broaden their knowledge of the outside world, and at the same time enable the Voice of America to get a better estimation of its coverage of the Chinese mainland.

LISTENING BRIEFS

EUROPE

GREECE: Athens is using a new frequency for the English broadcasts at 0215GMT. The frequency of 9515kHz is now used for the transmission which is also in Greek from 0300-0350GMT. The new frequency replaces 9690kHz.

SWEDEN: Radio Sweden has made a frequency change for the transmission to North America 1330-1500GMT. The station is now using 21610kHz, which replaced 21505kHz. English is heard on the new frequency at 1400GMT.

SWITZERLAND: Berne has been observed in the 13-metre band using several frequencies from 1030GMT, with an English broadcast at 1100GMT. Three frequencies have been received: 21520, 21545 and 21630kHz.

AFRICA

LYBIA: Signals from Tripoli have been heard on 5980kHz from 0600GMT, when a transmission in Arabic is heard. The broadcast commences with the national anthem and a station announcement, followed by regular programs until sign-off at 0800GMT. Douglas Doull of Auckland, NZ, reports reception of this frequency, while our reception has been a the same program on 5960kHz which also closes at 0800GMT.

UGANDA: Kampala has a new service to Europe, according to "Sweden Calling DXers". The broadcast is on 9685kHz in German till close down at 2103GMT. The transmission is on a test basis, according to announcements given by Radio Uganda at the end of the program.

AMERICAS

ARGENTINA: Radio Splendid in Buenos Aires has made a frequency move from 5985 to 6030kHz. The signal has been noted around 1000GMT but the frequency is not a good one for this area as there is some interference to the broadcast.

VENEZUELA: According to the BBC Monitoring Service, a ecent government announcement from Caracas stated that the La Voz de Venezuela is to be built. The initial installation will consist of a 1MW medium-wave station, and this will be backed up by short-wave transmitters. The government already operates Radio Nacional in Caracas.

New Products

HP 3467A Logging Multimeter

Recently released by Hewlett-Packard, the 3467A Logging Multimeter is a four-function DMM that also includes a four-channel scanner, a digital thermometer, maths function, and a printer in a single instrument.

HP's 3467A Logging Multimeter measures DC volts, resistance, true RMS AC volts and temperature. Temperature can be measured simultaneously with voltage or resistance to allow convenient analysis of temperature dependent parameters. Built-in maths functions can be used to convert measured inputs into units such as deviation, scaling, ratio and dB.

DC volts are measured with a sensitivity of 10 milliohms. A front panel zero adjustment can compensate for DC offsets of up to 2mV. Similarly, lead resistance of up to 20 ohms can be nulled out. A different zero offset for each channel may be stored and automatically subtracted from the readings.

Accurate true RMS AC voltage measurements with 10uV sensitivity can be made over a 100kHz bandwidth. The diode test function supplies a 1mA constant current to forward bias diodes without damage.

HP's new 3467A Logging Multimeter can be used to make a large number of measurements, because of its four channels and its maths capability. Measured values from the first three channels may be automatically subtracted, multiplied or divided by a manually entered constant to provide fast calculated measurements. Maths operations can also be performed on the first three channels with respect to a measured input on the fourth channel.

Direct measurements of temperature changes about ambient, frequency response of amplifiers in dB, attenuator flatness, or turns ratio of transformers are just some of the input measurements that can be made. All four inputs are floating and protected from overload.

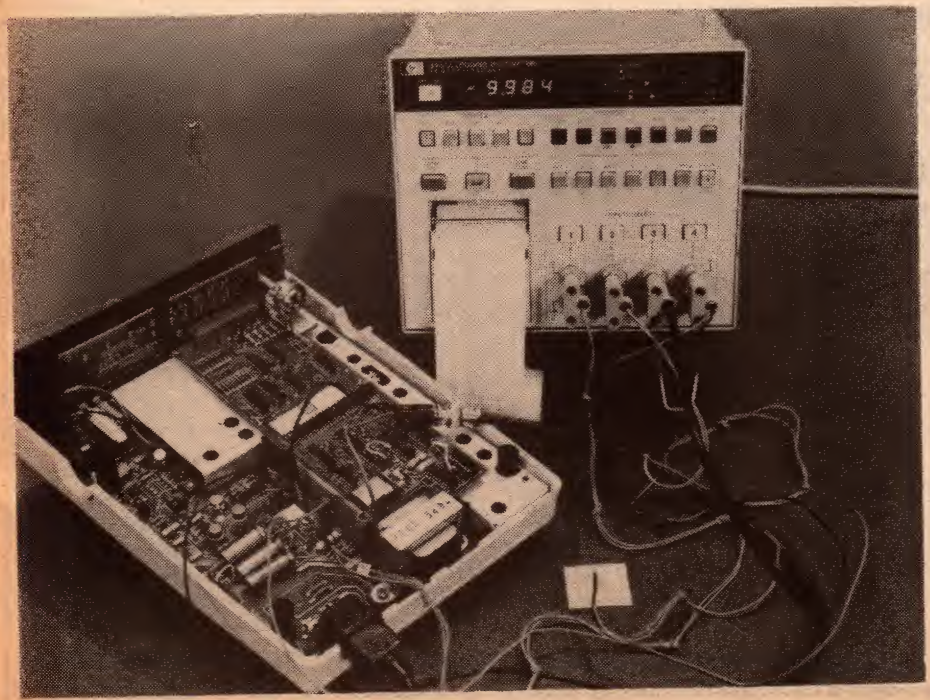
The built-in thermal printer with timer can automatically or manually record measured data. A manual print command initiates a print out of the selected input channels. The 3467A is easily set up for unattended measurements. It automatically scans, measures and records the selected channels with elapsed time information at selectable scan intervals from one second to three hours over a 24-hour period. A time offset can be entered, via the front panel, to synchronize the timer to the time of day.

If a momentary power failure should occur, the 3467A remembers the maths constant, elapsed time information, zero offsets and ranges.

Applications of the HP 3467A include monitoring charge/discharge cycles of batteries; monitoring output voltage drift versus time during circuit warm-up; sorting resistors according to per cent error; three-phase voltage measurements; and monitoring solar heating designs.

The instrument can also be used in telecommunications and audio applications, and can make dBm measurements referenced to any impedance. Amplifiers and filters can be characterized directly in dB. Hot spots on circuit boards can be measured at more than one location, and temperature changes printed directly on hard copy.

For further information contact Hewlett-Packard Australia Pty Ltd, 31-41 Joseph St, Blackburn, Victoria 3130.



Low-cost He-Ne laser

Quentron's Model 158 He-Ne laser is ideal for optics and communications experiments. Output power is 0.6mW, and it may be used either modulated or unmodulated. When used for voice communications, a small audio amplifier fitted with a photodetector (to convert it to an optical receiver) is also necessary.

Input impedance of the modulation transformer of the Model 158 is 8 ohms. It may be driven from the extension speaker outlet of a cassette player or radio.

Further information from Quentron Optics Pty Ltd, 576-578 Port Rd, Allenby Gardens, South Australia 5009.

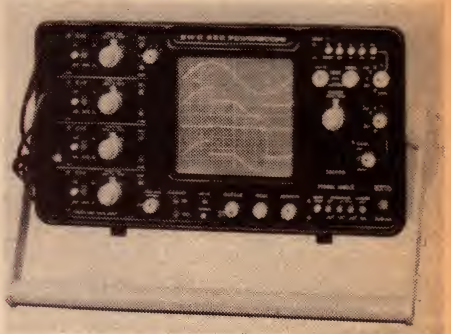
New Products

HV power scope

A new four-channel oscilloscope designed by BWD Electronics provides a safe means of displaying and measuring high voltages in the field of power engineering. The instrument is said to be the first of its kind, and patents have been taken out to cover the design concept. The BWD model 880 Powerscope is capable of measuring from 100mV to 1000V, phase angle from 0 top 359°, and time from 5ns to 100 seconds. All four channels can be viewed simultaneously.

Special attention has been given to minimizing shock hazard. The panel, knobs, shafts and input sockets are insulated. The input sockets are also deeply recessed and the probes are specially designed to provide safe connections to power lines and direct in-line equipment.

The four input amplifiers are sensitive enough to monitor control signals, interference and other low level signals less than 100mV, yet can also accommodate up to 660V RMS with overload to 3kV, without the use of divider probes.



The phase measuring section of the instrument is of special interest. It will accommodate power supply frequencies from 25Hz to 2kHz, and its digitally controlled phase-locked loop (PLL) will follow unstable frequency supplies such as small uncontrolled motor generators. The circuit provides an output pulse in 1° steps, selectable from 0 to 359° via a digital display. The pulse is 1° wide and may be used either for trace bright-up or as a timebase delay trigger.

When testing multiphase circuits, the phase pulse reference can be switched in 60° steps from 0 to 300°.

The power consumption of the model 880 is low and it may be operated from the AC power lines, DC or rechargeable batteries. Accessories availale include 1:1 ans 10:1 probes with 3kV peak operating voltage, sotrage over and camera.

Further information is available from BWD Electronics Pty Ltd, Miles Street, Mulgrave, Victoria, or Box 325, P.O. Springvale, Victoria 3171. Telephone (03) 561 2888, Telex 35115.

Capacitance meter

The new B & K model 820 digital capacitance meter combines digital accuracy with full portability. It provides 10 ranges, covering from 0.1pF to 999,900uF with a minimum resolution of 0.1pF. Because the accuracy of the instrument greatly exceeds the tolerance of most capacitors, it may thus be used for hand selection and matching of components for critical use. At the same time it is also very easy to use, even by untrained production workers.

The model 820 comes with tilt stand, detailed manual and a spare fuse. Optional accessories include the BC-28 battery charger, BP-28 rechargeable battery pack and LC-28 carrying case.

Further information from Parameters Pty Ltd, 68 Alexander St, Crows Nest, NSW 2065. Telephone (02) 439 3288.

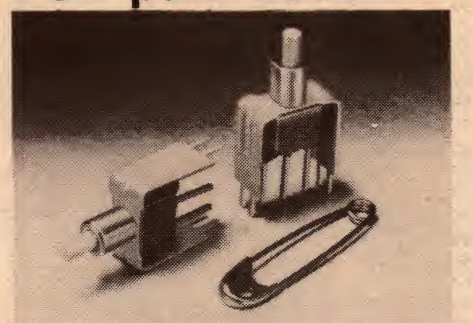
Miniature relay

The ITT Components type RZ miniature relay is capable of being plugged into standard DIL IC sockets, measuring only 20.2 x 9.8 x 11.2mm. However it is fitted with two changeover contact sets capable of switching 1.25A and up to 125V AC or 150V DC in dry circuits, or 60V AC/75V DC in full load circuits. Operate and release times at nominal coil voltage are less than 6ms and 3ms respectively.

Five models of the relay are available, with nominal coil voltages of 4.5, 6, 12, 24 and 48V. Contact action is very reliably, as a crossbar technique is used. Contact resistance is 50 milliohms typical, 100 milliohms maximum. Two different contact types are available, either AgPd 50 or AgPd 50 with 20um of AuAg. Typical contact life is 1 x 10^6 operations at 125V AC/50VA.

Further information is available from ITT distributor Instant Component Service, which has branches in most states.

PCB push button



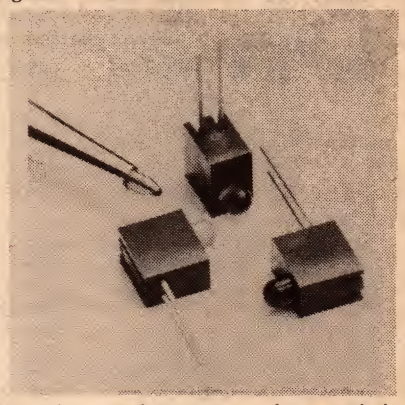
C & K Components has developed momentary snap-action PCB-mounting pushbuttons with anti-stress brackets for vertical mounting. Excessive force applied to the switch is absorbed by the U-shaped mount, and not transmitted to the switch casing, PCB terminals or tracks. The type V40 switches are available in both SPDT and DPDT types and offer either 1A/120VAC/28VDC rating or 0.4VA/20V(AC/DC). Electrical life is 60k cycles minimum at full load.

Further information from C & K Electronics (Aust) Pty Ltd, 2/6 McFarlane St, Merrylands, NSW or PO Box 101, Merrylands, NSW 2160. Telephone (02) 682 3144.

LED indicators

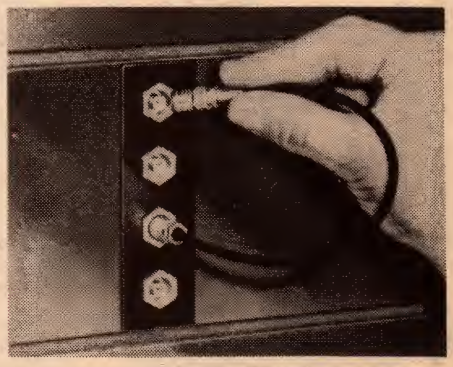
The new Dialight 551 series of LED logic status indicators offers high reliability and long life combined with low cost and a choice of colours. Each consists of a T-1 LED packaged in a case less than 5.1m wide, designed for either PCB or panel mounting. The indicators are available with red, yellow or green LEDs, a red model also being available with a built-in series resistor for direct 5V operation.

The indicators are suitable for TTL, DTL or RTL drive, with typical operating characteristics of 1.6-2.4V at 20mA DC or 2.2V at 10mA for 2.0 mcd luminous intensity. Size of the case is 4.6 x 6.4 x 7.4mm, with the lens of the LED extended by 2.5mm to provide a wide viewing angle.



Further information from Philips Electronics Components and Materials, 67 Mars Road, Lane Cove NSW.

RF connectors



A range of Sealectro RF coaxial connectors is now available for recessed front panel presentation. Models are available in both 50 and 75 ohm impedance and with screw or crimp type cable clamps. Clamps accept all standard coaxial cables such as RG 174/U, RG 188/AU and RG 316/U.

Full specifications, prices and other information from Acme Engineering Pty Ltd, 2-18 Canterbury Road, Kilsyth, Victoria.

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Illustrated above: Speaker fitted with acoustic foam grille (supplied).

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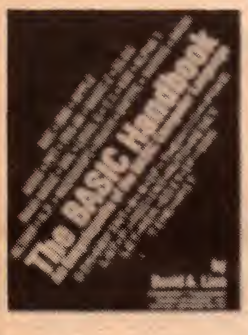
Books & Literature

BASIC encyclopedia

THE BASIC HANDBOOK: An encyclopedia of the BASIC Computer Language, by David A. Lien. Compusoft Publishing, San Diego, 1978. Soft covers, 180 x 229mm, 360pp. Price in USA $14.95.

Another book by Dr David Lien, the author of that well-known and widely acclaimed Tandy TRS-80 User's Manual — which is now virtually a classic because of its excellent readability. This one seems to me very likely to become a classic also, for the same reason. Obviously Dr Lien is no ordinary technical author, but one of the few gifted with the ability to really communicate.

What he has produced in this case is a general-purpose reference manual on the BASIC language — its commands, statements, functions, operators, syntax and so on. And not just for the original



Dartmouth BASIC, but for a very large number of the "dialects" now in use on computers big and small.

Each element of the language, in as many as possible of its known forms, is dealt with separately — but with cross references provided so you can work out how they go together. For each element you get what it does, how it is used, a sample of its usage, hints on its use, what to do if your computer/interpreter doesn't have it, known variations, and related elements to look up.

Sounds just what the doctor ordered, doesn't it? And it is. Just why no one thought of it before I don't know, but I think it's just as well that it had to wait for David Lien. If someone else had done it earlier, it probably wouldn't have been nearly as good, but would have stopped him doing it.

As it is, the conception is spot-on, the planning has obviously been thorough and the execution is excellent. Every entry I checked was clearly written and eminently satisfying. It's nice to be able to write that about any book.

In short, a book which belongs alongside every computer running BASIC. And as there are more computers running BASIC than any other language, that suggests Compusoft Publishing has a real winner!

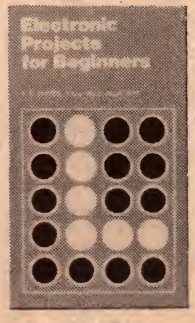
The review copy came from Dick Smith Electronics Pty Ltd, who say they hope to have stocks by the time this review is published. If you want a copy, I suggest you act fast — they're likely to go like hot cakes when word gets around. (J.R.)

Simple projects

ELECTRONIC PROJECTS FOR BEGINNERS, by F. G. Rayer. Bernard Babani (Publishing) Ltd, London, 1978. Soft covers, 108 pages, 112mm x 180mm, illustrated with circuits and wiring diagrams.

The term "beginner", as used in this title, is likely to be interpreted in different ways by different people, so it is probably worth commenting that the author fairly obviously intends the word to be taken literally, as judged by the simplicity of the projects. It is also significant that the first section (there are four in all) is devoted to "no soldering" projects.

The author explains this by pointing out that some parents may feel that a soldering iron is not without its dangers in the hands of young beginners.



Again, this serves to set the level at which the book is aimed.

In addition to the "no soldering" section already mentioned the three remaining sections cover "Miscellaneous", "Radio and Audio Frequency" and "Power Supplies". Between them they cover some 50 odd projects. There is also a useful list of equivalent semiconductors, together with drawings of typical base connections. (Unfortunately, with no indication as to whether these are above or underside views.)

To present this number of projects, with at least one and sometimes two drawings for each, in a book of this size is quite a task and, as can be imagined, does not leave a great deal of room for explanatory text. As a result, the text is almost exclusively devoted to how to build it, with little room to explain how it works. Even then, knowing the strife which beginners can encounter when working from much more detailed texts, one is forced to wonder whether the instructions are adequate.

Identification of components is also somewhat vague, such as a "300mW" or "1W" transistor, or "an output or speaker transformer", without any mention of impedance.

Another point worthy of comment is the inclusion of a project (a light dimmer) intended for direct mains connection, without a transformer. Granted, the author goes to some lengths to emphasise the need for care, but such a project seems out of place in a beginner's book.

These points aside, the book provides a useful collection of projects to hold the interest of the budding electronics enthusiast and, in conjunction with other texts, should help him put theory into practice. It would certainly make a useful addition to a beginner's library.

Our copy came direct from the publishers and the only price quoted is the English one of £1.35. No doubt it will become available through local booksellers shortly. (P.G.W.)

Logic handbook

MASTER HANDBOOK OF DIGITAL LOGIC APPLICATIONS, by William L. Hunter. Soft covers, 390 pages, 210 x 130mm, illustrated with photographs, circuits and diagrams. Published 1976 by Tab Books, Blue Ridge Summit, Pennsylvania. Price in Australia $10.95.

Pretentiously titled, this book could more correctly be regarded as a handbook on the characteristics of different logic families. Even then the main

Books & Literature — continued

emphasis is on high threshold logic and emitter-coupled logic.

Although aimed mainly at engineers and those already familiar with logic concepts, the first chapter of the book provides a brief review of basic logic circuits. The second chapter discusses the noise immunity of CMOS logic versus bipolar logic. Surprisingly, this is the only time that CMOS logic devices are discussed in the book, although the author writes mainly with industrial logic designers in mind.

The omission is even more surprising since the author devotes a complete chapter to the application of FETs in logic. He expounds their advantages of high fan-in and low power consumption, which are both possessed by CMOS logic.

Transistor-transistor-logic (TTL) is also virtually ignored.

The chapters on high-threshold logic and emitter-coupled logic are quite informative. Particularly useful in the ECL chapters is the information on design and use of micro-striplines on PCBs.

A final chapter discusses, in fair detail, some high frequency digital applications: IC crystal-controlled oscillators, a 500MHz frequency counter and a digital frequency synthesizer.

Summing up, this book will be of some use to logic designers but it certainly cannot be regarded as a comprehensive reference book. The review copy came from Technical Book and Magazine Company, 289-299 Swanston Street, Melbourne, Victoria 3000. (L.D.S.)

Digital transducers

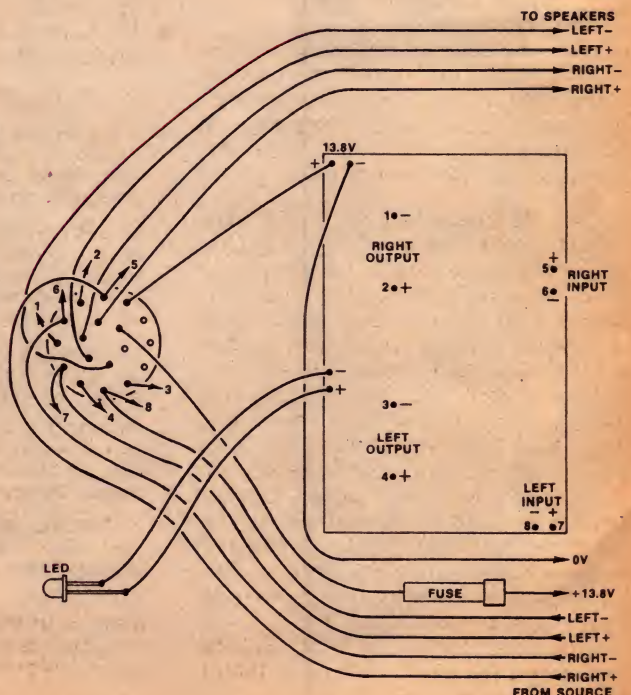
TRANSDUCERS IN DIGITAL SYSTEMS, G. A. Woolvet. Hard covers, 223 x 140mm, illustrated by photographs, circuits and diagrams. Published 1977 by Peter Peregrinus Ltd, PO Box 8, Southgate House, Stevenage, Herts. SG11HQ England. Price in UK £10.20.

According to the preface, this text provides a survey of transducers that give digital output. While it was published in 1977 and contains quite recent bibliographical entries, some of the text and diagrams appear quite dated. Transducers which are now commonly used, such as Gunn diode Doppler modules and Hall effect devices are not mentioned. LEDs are mentioned briefly but the whole area of solid state opto-electronics appears not to have been heard of. And A/D and D/A converters are treated as fairly esoteric devices available only from custom manufacturers, rather than the commonplace ICs they are now.

For this reason, the book seems likely to have only limited interest. Our review copy came direct from the publisher. (L.D.S.)

NOTES & ERRATA

25W STEREO BOOSTER (January 1979, File No. 1/SA/61); The switch wiring diagram on page 42 was not compatible with the overlay diagram on the same page, and also implied the wrong switch rotation. A corrected diagram is reproduced here.



INFORMATION CENTRE

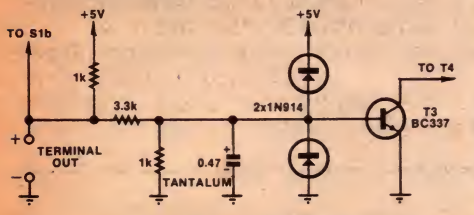
COMPONENT AVAILABILITY: With respect, the article "An Electronic Thermometer" in the November, 1978 issue contains a gross error. The final paragraph says that the AD590 IC is available. I wrote to Parameters on November 4th and they referred me to a local agent etc, etc. But so far no component.

That does not seem to me a reasonable meaning of the word "available". (C.B., West Perth, WA).

NOTES & ERRATA, cont.

COMPUTER TAPE INTERFACE (April 1977, File No. 2/CC/19): Readers experiencing difficulties in driving the unit with teleprinter rather than an electronic terminal may find it advantageous to change the base drive circuit of T3 so as to give a higher switching threshold.

The recommended circuit is reproduced below:



In some cases it may also be desirable to add a 1k pull-up resistor to the Q-bar output of FF3, to increase the available drive to T4.

MOVIE MIXER (September 1978, File No.1/MX/15): The 10k resistors used to convert the linear slider pots into log-law types should be connected from the rotors to ground, not from the rotors to the "top" ends.

HIGH PERFORMANCE TRAIN CONTROLLER (File No. 2/MC/16) October 1978. Some readers have expressed difficulty in obtaining the 12V 60/45W auto globe. In such instances a 12V 55W quartz halogen globe (available at auto accessory outlets) can be substituted. The only precaution necessary is to avoid touching the quartz envelope with the fingers.

Alternatively, any combination of 12V globes which add up to around 60W can be used. Typical combinations are three 12V 20W blinker indicator lamps wired in parallel, or two 12V 6/21W stop/tail lamps wired all four filaments in parallel (total 54W).

In all cases, at least one of the globes should be positioned under the 18mm hole in the PCB.

● Before publishing any project in "Electronics Australia", we check first to ensure that all parts will be available. The electronic thermometer was no exception. Heavy demand did lead to a temporary shortage of the AD590, but Parameters Pty Ltd quickly imported additional stocks and the supply situation is now back to normal. The device can be obtained in Perth from W. J. Moncrieff, 176 Wittenoom St, East Perth; or from Rablec Engineering, 255 Hay St, Subiaco. Radio Despatch Service, 869 Goerge St, Sydney also carry stocks of the AD590.

MINI-SCAMP MICROCOMPUTER: I have constructed the Mini-Scamp computer and have several technical queries regarding it, and it's connection to some of the computer peripheral devices featured as constructional articles in the magazine.

Firstly, is it possible to use the NRZ cassette interface unit, described in "Getting Into Microprocessors" with Mini-Scamp? If so, how would I go about adapting it from RS232 interfacing standards to 20mA current loop standards?

Secondly can Mini-Scamp be used in conjunction with the software-controlled Ultra Low Cost VDU? Would it be possible to generate a VMA signal from the SC/MP processor? If this VDU can be used, is more than 1k of memory required?

If extra memory is required, could the memory expansion board for the 2650 Mini-Computer be adapted? (A.P., Terrigal, NSW 2260).

● It is possible to use the NRZ recording technique with Mini-Scamp. As far as converting the circuits published to 20mA standards are concerned, you will have to work out the exact details yourself, as this is beyond the scope of the Information Service.

Again, Mini-Scamp can be used with the software controlled VDU, but again you will have to work out the exact interfacing details yourself. Extra memory will probably be required, and the memory boards from the 2650 Mini Computer could be used to provide this.

WHISTLE FILTER: Would you please consider publishing information on how to retune the 10kHz whistle filters currently used in wide band AM tuners. With the new broadcast station spacing of 9KHz the filters will need to be reset to 9kHz. The tuner which I have is the Playmaster 123. There would probably be many others who would like this information. (MC., Cranbourne South, Victoria.)

● There's not a great deal involved in the job, M.C. In fact with some whistle filter coils it may be possible simply to re-tune to 9kHz by adjustment of the coil slug or pot-core air gap. An alternative to this for circuits which use a 100mH whistle filter coil (like the Playmaster 123 Tuner) is to simply connect a 560pF capacitor across the coil and existing capacitors, whereupon the coil should need only slight adjustment.

As Leo Simpson explains in this month's article on pages 58-59, you can set the null to 9kHz reasonably well by ear.

If you are unable to complete an "Electronics Australia" project because you missed out on your regular issue, we can usually provide emergency assistance on the following basis:

PHOTOSTAT COPIES: $2 per project, or $2 per part where a project spreads over multiple issues. Requests can be handled more speedily if projects are positively identified, and if not accompanied by technical queries.

METALWORK DYELINES: Available for most projects at $2 each, showing dimensions, holes, cutouts, etc., but no wiring details.

PRINTED BOARD PATTERNS: Dyeline transparencies, actual size but of limited contrast: $2. Specify positive or negative. We do not sell PC boards.

PROJECT QUERIES: Members of our technical staff are NOT available to discuss individual projects, either in person at our office or by telephone.

REPLIES BY POST: Limited to advice concerning projects published within the past two years. Charge $2. We cannot provide lengthy answers, undertake special research or discuss design changes.

BACK NUMBERS: Available only until our stocks are exhausted. Within three months of publication, face value. Four months and older, if available, $2. Post and packing 60c per issue extra.

OTHER QUERIES: Technical queries outside the scope of "Replies by Post" may be submitted without fee, for reply in the magazine, at the discretion of the Editor.

COMMERCIAL, SURPLUS EQUIPMENT: No information can be supplied.

COMPONENTS: We do not deal in electronic components. Prices, specifications, etc., should be sought from advertisers or agents.

REMITTANCES: Must be negotiable in Australia and made payable to "Electronics Australia". Where the exact charge may be in doubt, we recommend submitting an open cheque endorsed with a suitable limitation.

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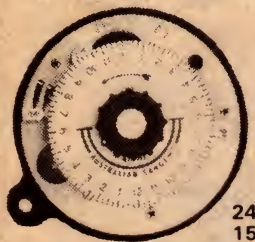

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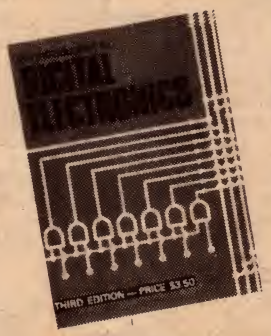

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ADVERTISING INDEX

The competition don't like the sound of this at all.

For quite some time, other manufacturers have been trying to produce tape with the qualities of the Maxell UD-XL. At the same time, Maxell have been quietly perfecting an even better series.

The UD-XL I and UD-XL II tapes are designed to attain maximum performance at the ferric and chrome position on your tape deck. Whichever tape position you choose, Maxell can give you a better performance.

UD-XL I TAPE, FOR FERRIC (norm.) POSITION (120*us*)

UD-XL I offers an excellent sensitivity of 1 dB higher than even UD-XL. MOL performance is also 1 dB higher over the entire audio frequency spectrum. The result is a new standard in ferric tape, with wider dynamic range and less distortion than ever before.

How does the UD-XL I compare then, with ordinary low-noise tapes?

Sensitivity is higher by 2.5 dB, and MOL performance by as much as 6 dB.

Yet, for all this UD-XL I requires no special bias or equalization. Simply set your tape selector as you normally would at the ferric position – but there the comparison ends.

UD-XL II TAPE, FOR THE CHROME POSITION (70*us*)

UD-XL II tape is such a dramatic improvement on most other tape that can be used in this position, that comparison is really unfair.

For example, if you're familiar with conventional chromium-dioxide tape, you'll know of the associated problems of poor output uniformity – plus low maximum output level and rather high distortion.

UD-XL II tape offers you excellent MOL, sensitivity, and an output improvement of more than 2 dB over the entire frequency range.

Maxell's unique 'Epitaxial' process gives you absolute sensitivity and stability, and no drop-out problems. What's more, the shells are moulded in diamond cut dies, and made to tolerances 5 times greater than the Philips standard. And, like all Maxell tapes, UD-XL II has the 5-second cleaning leader.

In short, if you're recording in the chrome position, you can now achieve all the advantages – with none of the drawbacks.

A prospect we think you'll find very exciting – even if the competition don't.

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For details on all Maxell Recording Tape write to Maxell Advisory Service, P.O. Box 49, Kensington, N.S.W. 2033

WT3/79

Pro. Series

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The bar graph FL (fluorescent) level meters are the most novel features of the RS-M85. Electronically controlled, so response time is instantaneous. these make conventional needle-type meters obsolete. Highly accurate, the FL meters give direct parallel readout for instant comparison between channels.

The capstan drive has a quartz-locked servo system that keeps tape speed constant. The record/playback head is laminated with Sendust, a recently developed material which is exceptionally hard and durable. Wide frequency response and negligible distortion contribute to the high quality in sound reproduction.

The RS-M85 is just one of the exciting models from the range of Technics cassette decks. See them for yourself at your dealer.

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